THE DEVELOPMENT OF NOUN-MODIFYING CONSTRUCTIONS IN CHILD MANDARIN

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Abstract

This thesis investigates the acquisition of noun modifying constructions (NMCs), in the form of [Modifier + *de* + (Noun)], attested in Mandarin-speaking children's naturalistic speech. Data came from 850 NMCs (including those traditionally defined as relative clauses (RCs)) produced by 135 Mandarin speaking children aged 3;00 to 6;00, from the cross-sectional naturalistic speech corpus "Zhou2" in CHILDES, and the 2699 NMCs (including RCs) attested in the mother-to-child speech in the same corpus. This thesis addresses the following issues and documents the associated phenomena: (i) subject-object preference in RC acquisition (Study 1); (ii) semantic relationships between modifier and head noun in developmental NMCs (Study 2); and (iii) headed-headless preference in NMC acquisition (Study 3). Both child output and adult input are considered across the three studies.

Study 1 addresses the issue of subject versus object preference in the acquisition of Mandarin RCs. Results indicated that object RCs are used more frequently than subject RCs in both child naturalistic speech and adult-to-child input. Such object preference differs from the developmental patterns observed in European languages, which show a clear subject over object advantage in RC acquisition (e.g. Diessel & Tomasello 2005; and review by Hsu et al 2009). The current new dataset based on naturalistic speech adds to the growing body of literature that object RCs are not necessarily more difficult than subject RCs in acquisition cross-linguistically (Kim 1987; Kidd et al 2007; Ozeki & Shirai 2007; Yip & Matthews 2007; Suzuki 2011； Chen & Shirai 2014). On the other hand, given that there are also mixed findings in the child Mandarin RC acquisition literature, future research is needed to examine the issue of subject-object asymmetry in greater depth in child Mandarin RC acquisition.

Study 2 characterizes the semantic relations between the modifier and the head noun of the NMCs, based on the generative lexicon framework (Pustejovsky 1995; Lenci 2000). All the NMCs attested in the corpus were classified according to the 4 major roles of qualia structure between the modifier and the head noun. Results indicated that NMCs (both in child output and adult input) expressing the formal facet of the head noun's meaning are most frequently produced, followed by those

expressing the constitutive quale, and then the telic or the agentive quale. Results also showed that the majority of NMCs expressing the agentive and telic quales are those "traditional" RCs (called RC-type NMCs here), while the majority of NMCs expressing the formal and constitutive quales are non-RC type NMCs (mostly involving adjectival or nominal modification). RC-type NMCs emerge either alongside the other non-RC type NMCs at the same time, or emerge later than non-RC type NMCs for the constitutive quale. The findings are consistent with the semantic nature and complexity of the four qualia relations: formal and constitutive aspects of an object (called natural type concepts in Pustejovsky 2001, 2006) are more basic attributes, while telic and agentive (called artificial type concepts in Pustejovsky 2001, 2006) are derived and often eventive (hence conceptually more complex).

Study 3 examines the use of headed NMCs versus headless NMCs. Consistent with previous findings (Flynn & Foley 2004; Packard 1988), children showed a clear early preference for headless over headed NMCs in their naturalistic speech, with headless structures being more frequently produced than headed structures at the early stages of development. As age increases, this headless over headed asymmetry gradually diminishes. This preference for headless structures, however, does not appear in the adult input data. Also interestingly, this general developmental preference for headless NMCs is not attested across all types of NMCs. For instance, whereas child NMCs expressing the formal facet of the head noun's meaning are more frequently headless; in striking contrast, the majority of child NMCs expressing the constitutive quale are headed across all the ages observed. This developmental phenomenon seems difficult to be accounted for by purely syntactic accounts (Flynn & Foley 2004; Packard 1988).

To summarize, the current naturalistic dataset are consistent with the developmental scenario in which the earliest NMCs in child Mandarin are frequently headless formal non-RC type; followed by headed constitutive non-RC type NMCs; and then RC-type NMCs. These findings are consistent with the idea that in Asian languages such as Japanese, Korean and Chinese, RCs develop from attributive constructions specifying a semantic feature of the head noun in acquisition (Diessel 2007, c.f. also Comrie 1996, 1998, 2002).

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Parts of the findings in Study 2 are published in the proceedings of the 26th Pacific Asia Conference on Language, Information and Computation 2012, and will appear as a book chapter in a forthcoming Chinese volume on Generative Lexicon Theory and Chinese Linguistics Research edited by Prof. Huang Chu-Ren and Prof. Song Zuoyan by the Commercial Press (expected to be published in 2015). The empirical findings on child output and adult input addressing the use of headless versus headed noun modification constructions and subject versus object relative clauses are equally interesting. I am thankful to my supervisor for encouraging me to publish the other findings in a journal paper.

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Chapter One
Introduction

1.1 Introduction

This dissertation investigates the acquisition of noun-modifying constructions (NMCs), in the form of [Modifier + *de* + (Head Noun)], attested in Mandarin-speaking children's naturalistic speech. In this construction, "*de*" is a functional word or a particle between the modifier and the head noun. Within Chinese linguistics, the most popular opinion is to treat "*de*" as a structural particle, connecting the modifier and the head noun (Zhu 1961; Lü 1980). In addition, "*de*" has widely been described as *Nominalizer* (Zhu 1961), *Modifier* (Rubin 1994, 2002), *Complementizer* (Cheng 1986), *Modification marker* (Guo 2000), *Linker* (den Dikken & Singhapreecha 2004; Huang 2007), *Conjunction* (Li 2007), *Determiner* (Simpson 2002), or *Light noun* (Zhang 1999). The head noun of NMCs can be unexpressed (i.e. in the form of "Modifier + *de*"), when the head noun has been explicitly mentioned in the discourse or is present in the speech context (Kong 1992), or the relation between the modifier and the head noun is transferable possession (Kong 1992, Zhang 2007). For example, in (1a), the relation between the head noun *wanju* 'toys' and the modifier *wo* 'I' is transferable possession, and the head noun could be unexpressed. While in (1b), the relation between the head noun *shou* 'hands' and the modifier *wo* 'I' is untransferable possession; in this case, the head noun should better be explicitly expressed.

(1) a. 我 的 (玩具) 在 那儿
wo de (wanju) zai nar
I DE (toys) be there
'My toys are there.'

b.我 的 手 脏 了
wo de shou zang le
I DE hand dirty LE
'My hands are dirty.'

In this dissertation, both headed (with head noun expressed) and headless (with head noun unexpressed) NMCs will be covered, hence, these constructions are generally represented in the form of [Modifier + *de* + (Head Noun)].

This chapter first describes the general theoretical background of the dissertation and then introduces the three studies in chapters two, three and four.

1.1.1 Noun-modifying Constructions (NMCs)

Matsumoto (1997) has proposed that noun-modifying clauses are a single class of constructions, in which a noun or a noun phrase is modified by an adnominal subordinate clause to form a complex noun phrase. Because of the complexity of the structure and the frequent and extensive uses within and across languages, noun-modifying constructions have attracted considerable attention in linguistic research.

Much research on noun-modifying constructions (NMCs) is based on English and other typologically related European languages. One frequently investigated type of NMCs is relative clauses (RCs) in these languages. Since 1980's, a new typology on noun-modifying constructions was proposed. The proposal is that noun-modifying constructions in certain Asian languages - such as Japanese, Chinese, Korean and Ainu- are qualitatively different from RCs in European languages (Matsumoto 1988; Comrie 1996). These Asian languages do not have a distinct RC construction but, rather, a general noun-modifying construction, of which RCs are merely a subset or special case with no syntactic operation such as gap filling or movement. According to Matsumoto (1997) and Comrie (1996), the noun-modifying constructions in these Asian languages are construed based on semantic and pragmatic relations between the modifier and the head noun.

The three studies in this dissertation focus on Mandarin noun-modifying constructions (NMCs). In Mandarin Chinese, the modifier precedes the head noun follows (hence, modifiers are pre-nominal). Within the complex noun phrases, the head noun can be modified by a pre-nominal subordinate clause, a noun phrase or an adjective. Furthermore, there is a structural particle *de* between the head noun and the modifier. As such, at a general level, there is a uniform structure of Mandarin complex noun phrases, in the form of "modifier *de* NP", in which "NP" is the head noun. In this dissertation, these complex noun phrases in Mandarin Chinese are called collectively noun-modifying constructions (NMCs), which are similar but not restricted to the noun-modifying clauses discussed in Matsumoto (1988).

1.1.2 Relative Clauses (RCs)

The traditionally defined relative clause construction has two components: the head noun and the modifying clause, in which the head noun plays an argument role in the modifying clause, as illustrated by an English example in (1).

(1) [the boy$_i$] [whom the woman saw e_i]
[Head Noun] [Relative Clause]

This construction has received a great deal of attention in theoretical syntax because understanding the structural relation between the two components and the derivation of the structure is helpful to illuminate the abstract nature of grammar. This construction has also been the focus of investigation in language acquisition research because its structural complexity provides a window to understanding the underlying mechanisms for acquiring and processing language. Even more interestingly, the ordering of the two components, the head noun and the relative clause, can vary to produce two major types of relative clauses[1] across languages of the world: i) head-initial relative clauses (the head noun precedes the relative clause, e.g. English, German etc.); and ii) head-final relative clauses (the head noun follows the relative clause, e.g. Chinese, Japanese, Korean etc.). See (2) for illustrative examples. Such linguistic variation in the same construction offers a good opportunity for cross-linguistic comparative studies.

(2) Two Major Types of Relative Clauses (with respect to the order between the relative clause and the head noun)

a. Head-initial relative clauses: [Head Noun] [Relative clause]

b. Head-final relative clauses: [Relative clause] [Head Noun]

Mandarin Chinese has a basic SVO (subject-verb-object) word order, which is the same as that in English, as exemplified in (3).

(3) a. English

That boy saw a dog.

b. Chinese

那个 男孩 看见 一只 小狗

[1] According to Matthew S. Dryer (2013), across languages of the world, there are several types of relative clauses with regard to the order of relative clause and head noun, including, for instance, noun-relative clause, relative clause-noun, and internally headed. Among these varieties, the two basic types are that the relative clause follows the head noun, and that the relative clause precedes the head noun.

na-ge nanhai kanjian yi-zhi xiaogou.
that-CL boy see one-CL dog
'That boy saw a dog.'

However, the internal configuration of noun phrases (NPs) is different in these two languages. In English, modifying clauses of a noun phrase appear after the head noun; in Mandarin Chinese, in contrast, modifying phrases appear before the head noun. The position of relative clauses, which serve a modifying function in NPs, clearly illustrates this difference: English has head-initial relative clauses, as shown in (4a), where the head noun, "*the boy*", precedes the relative clause "*who likes the cat*". Mandarin Chinese has head-final relative clauses, as shown in (4b), where the head noun, *na-ge nanhai* "that boy", follows the relative clause, *xihuan na-zhi mao* 'who likes that cat'. The linking element, *de* occurs after the relative clause and before the head noun in Mandarin Chinese.

(4) a. English: Head-initial Relative Clause
[the boy] [who likes the cat]

b. Chinese: Head-final Relative Clause
[喜欢 那只 猫] 的 那个 男孩
[xihuan na-zhi mao] de [na-ge nanhai]
[like that-CL cat] DE [that-CL boy]
'the boy who likes that cat'

1.2 General Background

The studies in this dissertation take a constructional view of grammar and treat Mandarin *de* marked complex noun phrases as instances of a general noun-modifying construction, in the form of, "modifier + *de* + (head noun)". In addition, relative clauses are treated as a subset of noun-modifying constructions. These studies examine the acquisition of noun-modifying constructions (NMCs), focusing on NMCs both in child output and adult input. The major theories and hypotheses discussed in this dissertation are highlighted in the subsections below. The details are described in the respective chapters.

1.2.1 Theoretical Background Accounting for the Subject-object Asymmetry in the RC Literature

Theories of sentence processing make different predictions for the acquisition of RCs in Mandarin Chinese, with respect to whether subject or object RCs are easier to process.

For example, some theories of language processing consider the surface structure of a sentence. For these theories, some consider the linear distance between the head noun and the gap position, which determines the processing load of the relative clause (see, e.g., the Dependency Locality Theory of Gibson 1998, 2000), while others focus on the canonical word order effect (see, e.g., Bever 1970, Diessel and Tomasello 2005). As we will see in Chapter 2, theories that consider the surface sentence structure predict that object-gapped RCs should be easier to process than subject-gapped RCs in Mandarin Chinese.

There are some other processing theories that consider the structural distance between the head noun and the gap position in a hierarchical sentence structure of the RCs, for instance, the Structural Distance Hypothesis (O'Grady 1997), the Relativized Minimality Principle (Rizzi 2004), and the Structure-Based Theory (Lin & Bever 2006). Theories along this perspective consider the "depth" of the gap position in the hierarchical sentence structure. As we will see in section 2.2.3, these theories predict that subject-gapped RCs are easier to process than object-gapped RCs in Mandarin Chinese.

In addition to the theories of sentence processing, a putative cross-linguistic generalization, The Noun Phrase Accessibility Hierarchy (NPAH, Keenan & Comrie 1977), describes differential ease of relativizing different syntactic positions both within one language and across languages. According to NPAH, the higher the grammatical relation is on the hierarchy, the easier it is for that syntactic position to be relativized. Hawkins (2004) proposed that the linguistic ranking of NPAH is based on the processing demands of structural domain for the relativized position, that is, the higher the syntactic position is on the hierarchy, the less demanding it is for the processor. If we consider these processing demands also relevant for language acquisition, NPAH will predict that subject RCs are easier to process than object relatives in acquisition across languages, since the subject position is higher than a direct object position in the hierarchy (see section 2.2.4).

1.2.2 Generative Lexicon Theory

Generative Lexicon (GL) Theory (Pustejovsky 1995) has become one of the most influential theories in semantics. In GL theory, each lexical entry has the following four levels of representation:

1) Argument Structure: Specification of the number and the type of logical arguments, and how they are realized syntactically.

2) Event Structure: Definition of the event type of a lexical item or a phrase, including State, Process, and Transition. Events may have sub-eventual structure.

3) Qualia Structure: Modes of explanation, which are composed of Formal, Constitutive, Telic and Agentive roles.

4) Lexical Inheritance Structure: Identification of how a lexical structure is related to other structures in the type lattice, and its contribution to the global organization of a lexicon.

Within these semantic levels, the qualia structure reflects modification relations in the semantic composition within a compound (Lenci et al. 2000). As NMC in Mandarin Chinese is composed of a modifier and a head noun, there exists modification relation between the modifier and the head noun. Study 2 (see Chapter three) in this dissertation therefore attempts to use qualia structure relations as a framework to analyze the semantic relations between the modifier and the head noun of NMCs.

1.2.3 Semantic Types of Possessive Relation

It was proposed in the study of Heine (1997), Langacker (1991, 1995), Alexiadou (2001, 2003), and Nikolaeva & Spencer (2010) that alienable and inalienable possessions are two basic semantic types of the possessive relation between the modifier and the head noun within a noun phrase.

The distinction between alienable and inalienable possession is widespread across languages (see Heine 1997; Coene & D'hulst 2003 for reviews). This is based on the distinction between entities that cannot be separated from their owners and those that can be. Thus, it has been suggested that kinship relations (e.g., *George's mother*), part–whole relations (e.g., *George's arm*), physical and mental states (e.g., *George's fears*), and derived nominals (e.g., *George's singing*) are all likely to be

treated as inalienable. An alienable possessive relation, by contrast, depicts possessive relations between entities that are relatively independent in terms of their existence. As we will see in Chapter four, our naturalistic data indicate that the semantic type of the possessive relation between the modifier and the head noun influences the use of headed versus headless NMCs.

1.2.4 Usage-based Theory

The usage-based approach of language acquisition proposed in Tomasello (2003) and Lieven & Tomasello (2008) is a cognitive-functional approach to the study of language acquisition. One central idea is that language structure emerges from language use.

Usage-based theories hold that the essence of language is its symbolic dimension, with grammar being derivative. According to the usage-based theory, there is no such thing as universal grammar and so the theoretical problem of how a child links it to a particular language does not exist. It is thus a single process theory of language acquisition, in the sense that children acquire the more regular and rule-based constructions of a language in the same way they acquire the more arbitrary and idiosyncratic constructions: they learn them. And, as in the learning of all complex cognitive activities, the language learners construct abstract categories and schemas out of the concrete items they have learned. Thus, in this view, children's earliest acquisitions consist of concrete linguistic items, such as words (e.g. *cat*), and multi-word expressions (e.g., *I-wanna-do-it*) and constructions with some abstractions (e.g., *Where's-the* ____, which are partially concrete and partially abstract). Young children do not operate with adult-like abstract categories and schemas early in development.

According to this approach, young children construct more abstract linguistic constructions from generalizing across the relevant instances of more concrete linguistic items and expressions, based on similarity in form and function. More abstract (general) and complex constructions *emerge* along the process of development.

Children construct these abstractions gradually with some instances or lower level (subtype) constructions emerging earlier than the others that are of a similar type from an adult perspective – due quite often to the properties of the adult input.

Adult input is one important factor, among others, in influencing the course of language acquisition. Adult input studies are therefore important to include to evaluate the role of adult input. In this dissertation, both child output and adult input are considered across all the three studies.

1.3 Current Studies

Three studies are conducted to examine the acquisition of Mandarin NMCs in this dissertation. The three studies are based on the naturalistic data of 850 NMCs produced by 135 Mandarin speaking children aged 3;00 to 6;00, and the 2699 NMCs attested in the mother-to-child speech in the same corpus.

Study 1, which is introduced in Chapter two, addresses the issue of subject versus object preference in the acquisition of Mandarin RCs. According to Matsumoto (1988) and Comrie (1996), certain Asian languages do not have a distinct English type RC construction but, rather, a general noun-modifying construction, of which RCs are merely a subset or special case with no syntactic operation such as gap filling or movement. Since the traditionally defined RCs are a subset of NMCs, and the study of Mandarin RCs will provide a good opportunity to explore and examine some important issues that studies on post-nominal RCs cannot provide, this dissertation addresses issues in the acquisition of RCs in addition to the investigation of Mandarin NMCs in general.

The issue of whether subject or object RCs are more difficult to acquire in Mandarin Chinese is intriguing. Currently, many theoretical assumptions and hypotheses are based on RCs in commonly investigated languages, such as English, German and other European languages with post-nominal RCs (i.e., the relative clause appears after the head noun). However, Mandarin Chinese has a typologically rare combination of configurations: SVO basic word order plus pre-nominal RC, which leads to competing processing demands in acquisition. The processing theories based on surface sentence structure and those based on hierarchy sentence structure make different predictions, with regard to whether subject or object RCs are easier to process in Mandarin Chinese. In fact, certain hypotheses predict object RCs being easier to process or acquire than subject RCs in Mandarin Chinese, a prediction that runs opposite to that in the case of English RCs for example (where these two types of processing theories make the converging prediction that subject RCs are easier to

process and acquire than object RCs). Therefore, studying Mandarin RCs, provide a testing ground for different theories or hypotheses with regard to the issue of subject-object asymmetry (see Chapter two).

Moreover, even in existing studies on Mandarin RC acquisition, mixed findings have been found on the issue of subject-object asymmetry. Some studies found a subject-gap RC preference (e.g., Lee 1992; Cheng 1995; Hsu et al. 2009), some found no difference between the acquisition of subject-gap and object-gap RCs (e.g., Chang 1984; Su 2004), and some found an object-gap RC preference (e.g., Ning & Liu 2009， Chen & Shirai 2014).

Study 1 analyzes 113 RCs produced by 135 children in their naturalistic speech, examining the patterns of usage and preference of subject and object RCs in naturalistic speech. Unlike most of the previous studies (except Chen & Shirai 2014), this dissertation also did a parallel study on the 580 RCs attested in the mother-to-child speech in the same corpus, which provides the empirical basis to evaluate the relationship of child output and adult input. The new dataset in this study adds to the growing body of literature on the topic of subject-object preference in Mandarin RC acquisition.

Linguists such as Matsumoto (1988, 1997) and Comrie (1996) proposed that RCs in certain Asian languages, such as Japanese and Mandarin Chinese, are not governed by syntactic operations between the modifier and the head noun, but are instead construed based on semantic and pragmatic relations. If we adopt this perspective, Chinese RCs call for an approach that places more emphasis on the role of semantics and pragmatics, rather than syntax, in accounting for the processing and acquisition of these constructions (Matsumoto 1988, 1997; Comrie 1996). This dissertation attempts to adopt the perspectives proposed in Matsumoto (1988, 1997) and Comrie (1996), treating RCs as a subset of NMCs in Mandarin Chinese. In particular, study 2 (see Chapter three) attempts to investigate the acquisition of Mandarin NMCs from a semantic perspective. Study 2 characterizes the semantic relations between the modifier and the head noun of Mandarin NMCs in both child output and adult input based on the generative lexicon framework (Pustejovsky 1995; Lenci 2000), and documents the associated phenomena. Unlike many previous studies, the study examines the semantic properties of Mandarin NMCs (including those traditionally

defined as RCs) under a single framework. Specifically, the study analyzed 850 Mandarin NMCs produced by 135 children aged 3;00-6;00, and the 2699 NMCs attested in the mother-to-child speech. Based on the four qualia structures in the Generative Lexicon (GL) Theory (Pustejovsky 1995), the NMCs are classified into four different semantic types. The new data and the observed developmental patterns may serve as a basis or reference for inspiring more experimental work examining the acquisition of NMCs from a semantic approach. Such cross-linguistic findings may reveal some robust descriptive generalizations about the acquisition of NMCs from a semantic perspective. This study is probably the first of using the generative lexicon framework in the field of child language acquisition.

Recall that NMCs in Mandarin Chinese are in the form of [Modifier + *de* + (Head Noun)]. The head noun can be expressed or unexpressed. The former is called headed NMC, and the latter headless NMC. Study 3, in Chapter four, examines the use of headed NMCs versus headless NMCs in child output and adult input. Existing acquisition studies examining the issue of headness (i.e., whether the head noun is expressed or unexpressed) of RCs and Mandarin *de* constructions are mostly from a structural perspective (with a recent study by Cheng (2011) addressing this issue from a discourse functional perspective as an exception). In addition, previous studies have not examined and discussed about the role of adult input. Unlike previous studies, study 3 attempted to examine whether semantic relations between the modifier and the head noun influences the use of headed and headless constructions. Moreover, study 3 also conducted an input study on the use of headed and headless NMCs in the adult input data to evaluate the role of adult input.

The last chapter (Chapter 5) offers a summary of the major findings and a general discussion for the three studies. This chapter discusses the issue of subject-object RC preference in child Mandarin, the developmental pattern of NMCs with different qualia roles, and also how semantic characteristics of NMCs influence the use of headed versus headless NMCs in child Mandarin. In addition, the role of adult input in NMC acquisition is discussed in this chapter.

Chapter Two

The Use of Subject RCs versus Object RCs

2.1 Introduction

The issue of whether subject or object RCs are more difficult to acquire in Mandarin is intriguing. Mandarin RCs are pre-nominal which is unusual among SVO languages of the world. In Dryer's (2005) sample of 879 languages, only 5 languages have the combination of SVO basic word order plus pre-nominal RCs. Given this special configuration, theories of sentence processing and syntactic acquisition make diverging predictions for Mandarin with respect to whether subject or object RCs are more complex to process and acquire. Specifically, theories that compute processing complexity based on hierarchical sentence structure predict Mandarin subject RCs being less complex (and hence easier); while theories that consider complexity based on surface/linear sentence structure predict Mandarin object RCs being less complex (and hence easier).

Study 1 is a corpus study attempting to address the issue of subject versus object preference in the acquisition of Mandarin RCs. The study documents the use of subject versus object RCs in Mandarin-speaking children's spontaneous speech samples across age. In addition, there is a parallel analysis of the same corpus on the use of subject versus object RCs in the adult child-directed speech samples. Section 2.2 first reviews the relevant acquisition literature on relative clauses, including Chinese RCs and RCs in other languages. Section 2.3 describes the methodology and states the research questions. Section 2.4 presents the results. Section 2.5 discusses the findings. Section 2.6 offers some concluding remarks.

2.2 Literature Review

2.2.1 Relative Constructions in English and Mandarin

The English relative constructions illustrated in (1) offer examples of post-nominal RCs commonly found in European languages.

(1) a. [$_{\text{head noun}}$ the boy$_i$] [$_{\text{RC}}$ that e_i saw John] (subject extracted RC)

b. [$_{\text{head noun}}$ the boy$_i$] [$_{\text{RC}}$ that John saw e_i] (object extracted RC)

A relative construction consists of two parts: a subordinate clause and some expression whose reference is modified by this subordinate clause. The subordinate clause is called an RC and the expression modified by the RC is called the head noun phrase. In English, the RC follows the head noun (hence called "post-nominal") and within the RC there is a gap, which is coreferential with the head noun phrase. If the gap is in the subject position, it is called a subject RC, such as in (1a). Similarly, if the gap is in the object position, it is called an object RC , such as in (1b).

A Mandarin RC also includes two parts: a clause and a head noun. However, different from English RCs, Mandarin RCs are pre-nominal. That is, the RC precedes the head noun that it modifies. For example, in (2a), the RC 看见张三 *kanjian Zhangsan* 'saw Zhangsan' precedes the head noun '男孩' *nanhai* 'boy'. As for the gap inside the RC, which is similar to that in English, there are also subject (as in 2a) and object RCs (as in 2b).

(2) a. [$_{RC}$ e_i 看见 张三] 的 [$_{head\ noun}$ 男孩 $_i$]
kanjian Zhangsan de nanhai
see Zhangsan DE boy
'The boy who saw Zhangsan'
b. [$_{RC}$ 张三 看见 e_i] 的 [$_{head\ noun}$ 男孩 $_i$]
Zhangsan kanjian de nanhai
Zhangsan see DE boy
'The boy whom Zhangsan saw'

2.2.2 Processing Demands Based on Surface Sentence Structure

Some theories of language processing consider the linear distance between the head noun and the gap position, which determines the processing load of the relative clause (see, e.g., the Dependency Locality Theory of Gibson, 1998, 2000). The idea is that the processor has to keep the filler (the head noun in the case of RC) together with its reference in working memory until it encounters the gap where the filler can be integrated into the clause. The longer the linear distance between the head noun and the gap position, the more taxing it would be for the processor. This is because the computation of the integration cost is assumed to be linearly related to the number of discourse referents in the intervening region that must be maintained in working memory until dependencies can be resolved.

According to this proposal, an object RC in English, such as (3b), is harder to process than a subject RC, such as (3a), because the linear distance between the filler (head noun *the boy*) and the gap position (e_i) is longer with more intervening discourse referents in (3b) than in (3a).

(3) a. This is [$_{\text{head noun}}$ the **boy$_i$**] [$_{\text{RC}}$ that ***e*$_i$** saw John] (subject RC)

b. This is [$_{\text{head noun}}$ the **boy$_i$**] [$_{\text{RC}}$ that John saw ***e*$_i$**] (object RC)

However, because Mandarin RCs are pre-nominal, theories based on linear distance make the opposite prediction regarding the question of processing ease of subject versus object RCs. That is, a subject RC (as in 4a) is harder to process than an object RC (as in 4b), because the linear distance between the gap and the head noun is longer in a subject RC.

(4) a. 这是[$_{\text{RC}}$ e_i 看见 张三] 的 [$_{\text{head noun}}$ 男孩 $_i$] (subject RC)
zhe shi kanjian Zhangsan de nanhai
this is see Zhangsan DE boy
'This is the boy who saw Zhangsan.'

b. 这是 [$_{\text{RC}}$ 张三 看见 e_i] 的 [$_{\text{head noun}}$ 男孩 $_i$] (object RC)
zhe shi Zhangsan kanjian de nanhai
this is Zhangsan see DE boy
'This is the boy whom Zhangsan saw.'

Another theoretical proposal takes the canonical word order effect into account (see, e.g., Bever 1970, Diessel and Tomasello 2005). According to this proposal, a subject English RC, such as (5a), is easier to process than an object RC such as (5b), because the English subject RC has a word order that is the same as the canonical SVO word order in the main clauses of the target language, but the English object RC does not.

(5) a. This is [$_{\text{head noun}}$ the boy$_i$] [$_{\text{RC}}$ that e_i saw John] (subject RC)
S V O

b. This is [$_{\text{head noun}}$ the boy$_i$] [$_{\text{RC}}$ that John saw e_i] (object RC)
O S V

As for Mandarin RCs, since the object RC (as in 6b) is structurally similar to the SVO canonical word order in Chinese main clauses, it is easier to process than a subject RC (as in 6a), which has a different structure from SVO word order in Mandarin Chinese.

(6) a. 这是[$_{RC}$ e_i 看见 张三] 的 [$_{head\ noun}$ 男孩$_i$] (subject RC)
V O S
zhe shi kanjian Zhangsan de nanhai
this is see Zhangsan DE boy
'This is the boy who saw Zhangsan.'

b. 这是 [$_{RC}$ 张三 看见 e_i] 的 [$_{head\ noun}$ 男孩$_i$] (object RC)
S V O
zhe shi Zhangsan kanjian de nanhai
this is Zhangsan see DE boy
'This is the boy whom Zhangsan saw'

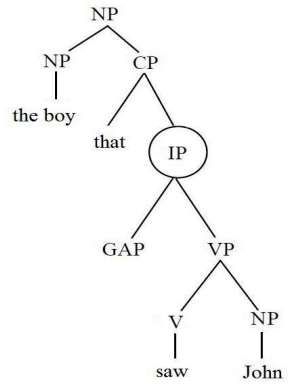
As we see, hypotheses concerning linear distance and similarity to canonical word order predict that English subject RCs are easier to process than English object RCs. By contrast, these hypotheses predict that Mandarin object RCs are easier to process than subject RCs.

2.2.3 Processing Demands Based on Hierarchical Sentence Structure

There are some other processing theories that consider the distance between the head noun and the gap position in the RCs. For instance, the Structural Distance Hypothesis (O'Grady 1997), the Relativized Minimality Principle (Rizzi 2004) and the Structure-Based Theory (Lin & Bever 2006) all pay attention to the structural distance between the head noun and the gap. Theories along this perspective consider the "depth" of the gap position in the hierarchical position of the sentence structure. The more deeply embedded the gap position is in the hierarchical structure, the longer the *structural* distance is between the filler (head noun) and the gap position, hence the more taxing it would be for the processor. According to these theories, processing difficulty is calculated based on the distance of syntactic operations: "…the distance traversed by a syntactic operation, calculated in terms of number of nodes crossed, determines a structure's relative complexity…." (O'Grady 1997: 179). For example, English subject RCs such as (7a) are easier to process than object RCs such as (7b), because the gap and the head are separated by one node in (7a), whereas it is separated by two nodes in object RCs. These structural representations are based on those proposed by Kwon (2006).

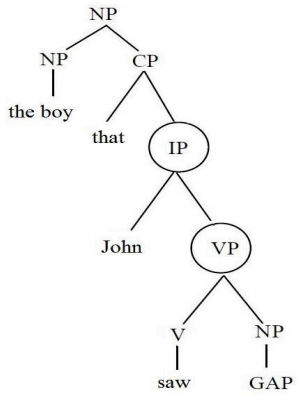
(7) a. Gap position in an English subject RC

[$_{\text{head noun}}$ the boy$_i$] [$_{RC}$ that e_i saw John]



b. Gap position in an English object RC

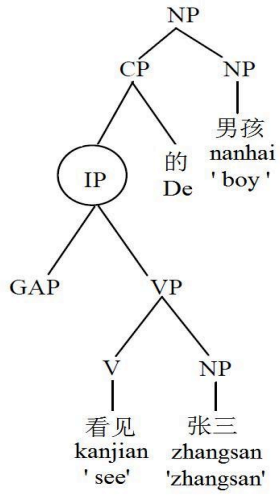
[$_{\text{head noun}}$ the boy$_i$] [$_{RC}$ that John saw e_i]



The situation of how processing demands based on hierarchical sentence structure apply in Mandarin is similar to that in English. The hierarchical structure of the following examples of Mandarin subject and object RCs in (8a) and (8b), respectively, show that the gap is also more embedded with an object RC (with two nodes between the head noun and the gap in (8b)), than with its subject RC counterpart (with only one node between the head noun and the gap in (8a)). This is similar to the case in English as shown in (7a) and (7b). Therefore, unlike surface structure-based theories, hierarchical structure - based theories would predict a subject over object advantage in the processing and acquisition of both English and Mandarin RCs.

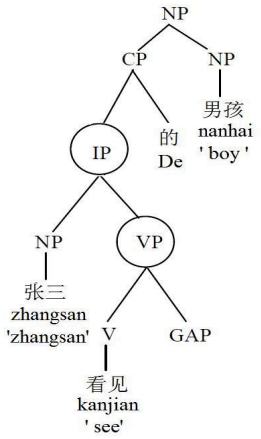
(8) a. Gap position in a Mandarin subject RC

[$_{RC}$ e_i 看见 张三] 的 [$_{\text{head noun}}$ 男孩$_i$]
kanjian Zhangsan de nanhai
see Zhangsan DE boy
'the boy who saw Zhangsan'



b. Gap position in a Mandarin object RC

[$_{RC}$ 张三　　看见 e_i] 的 [$_{head\ noun}$ 男孩$_i$]
Zhangsan kanjian de nanhai
Zhangsan see DE boy
'The boy whom Zhangsan saw'



In summary, for English RCs, processing theories make a consistent prediction that subject RCs are easier to process than object RCs, no matter whether the theory is based on linear distance, word order or hierarchical structure of a sentence. As for Mandarin RCs, processing theories make competing predictions: (a) theories based on linear distance and surface word order predict that object RCs are easier to process, while (b) theories that consider hierarchical sentence structure predicts that subject RCs are easier to process.

2.2.4 The Noun Phrase Accessibility Hierarchy

A putative linguistic universal that figures prominently in the literature on RCs is

the Noun Phrase Accessibility Hierarchy (NPAH, Keenan & Comrie 1977). NPAH is a typological generalization that describes the differential ease of relativizing different syntactic positions both within one language and across languages. That is, certain syntactic positions are consistently easier to relativize than the others. This forms a hierarchy of a ranking of grammatical relations played by a noun phrase based on accessibility to relativization. The higher the grammatical relation is on the hierarchy, the easier it is for that syntactic position to relativize. The hierarchy is shown here in (9):

(9) Noun Phrase Accessibility Hierarchy (> means "higher than"):

Subject > Direct Object > Indirect Object > Oblique > Genitive > Comparative

In the NPAH hierarchy, a subject position is higher than a direct object position. This means that a noun phrase in subject position is easier to relativize than one which is in object position. According to this, subject RCs are predicted to be easier to process than object RCs. Such a prediction is supported by the acquisition findings from languages with post-nominal RCs. In these languages, a subject over object advantage is robustly observed (see e.g. Diessel & Tomasello 2005 for English and German, Tjung 2006 for Indonesian).

When we consider how NPAH applies to English and Chinese, for English RCs, NPAH predicts a subject over object advantage. As for Mandarin RCs, NPAH would again predict subject over object advantage. As such, processing theories make competing predictions in Mandarin: theories concerning linear distance and word order predict an object over subject advantage; but theories considering hierarchical sentence structure and the NPAH predict a subject over object advantage.

2.2.5 Subject-object Asymmetry in the Acquisition of RCs in European Languages

The following section summarizes several studies which report a clear subject over object advantage in RC acquisition in several European languages.

Diessel and Tomasello (2000) studied children's naturalistic speech and examined the development of RCs in the speech of four English-speaking children between the ages of 1;09 and 5;02. They found that the order of frequency of relative clauses used by children is as follows: SU (53.0%) > DO (32.6%) > OBL (14.4%) relatives. The first ten relative clauses produced by each child were limited to SU

relatives (72.5%), while OBL relatives were very infrequent (5.0%), which suggests that SU relatives are acquired earlier than DO and OBL relatives in English.

Diessel and Tomasello (2005) conducted a sentence repetition task in which 21 English-speaking children and 24 German-speaking children repeated six different types of relative clauses: 1) intransitive subject relatives (S), 2) transitive subject relatives (A), 3) direct object relatives (P), 4) indirect object relatives (IO), 5) adverbial relatives (ADV), and 6) genitive relatives (GEN). The result was that both the English-speaking and German-speaking children in the study showed a higher percentage of accuracy when repeating subject RCs than when repeating object RCs, which indicates a clear subject over object advantage in RC acquisition. See Figure 2.1 for the results.

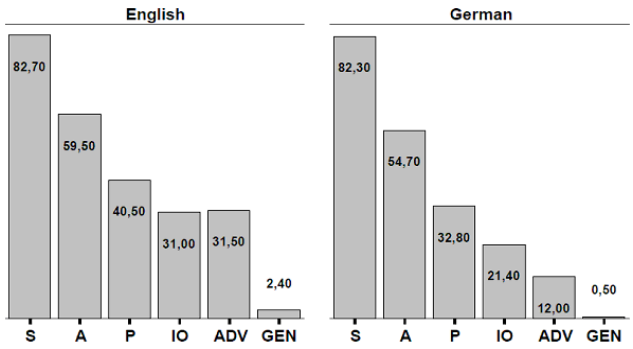


Figure 2.1 Correct Responses (Diessel & Tomasello 2005)

Brandt, Diessel and Tomasello (2007) also observed a subject over object advantage in child German. They examined a corpus of 783 finite relative clauses produced by a German-speaking boy from the age of 2;00 to 5;00. The result shows that subject relatives are dominant among the earliest relative clauses.

Friedmann & Novogrodsky (2004) assessed the comprehension of RCs in ten Hebrew-speaking school-aged children with syntactic SLI (Specific language impairment) and two groups of younger children with normal language development. The subject RCs and object RCs were assessed by conducting a binary sentence-picture matching task. The results showed that in each group, the children made more correct responses involving subject RCs than the object RCs (see Table 2.1). The result of this study also shows a subject advantage in RC acquisition.

Table 2.1 Mean Correct Percentages by Group and Sentence Type (S.D. in bracket)

	Age	Simple SVO	Subject relative	Object relative
Four-year-old	4;00-5;00	93.5 (1.6)	85.5 (1.9)	58 (4.4)
Six-year-old	5;11-6;05	99 (0.4)	95 (1.0)	86 (2.6)
SLI	7.03-11;02	96.5 (0.5)	98.5 (0.5)	62 (2.9)

(Friedmann & Novogrodsky 2004)

Belletti and Contemori (2010) studied the production of subject and object RCs by Italian-speaking children aged 3;04 to 6;05 and by adults. 48 Italian-speaking children participated in the study. In their experiment, an investigator presented two options and asked the participants to choose one. Ten items elicited subject RCs (For example, the participants were told that there are two children. One child is eating chocolate; the other child is eating ice cream. Which child would you rather be?). Ten items elicited object RCs (For example, the participants were told there are two children. The doctor is examining one child; the nurse is examining the other child. Which child would you rather be?). The children's task was to answer the question starting with ''I would rather be the child. . .''.

The authors reported that subject RCs were produced with no particular difficulty by children from very early on, while the production of object RCs was avoided by all children. This indicated that object RCs are systematically harder than subject RCs for children at all the ages tested. The study showed that the production of an object RC was avoided by the children in various ways, a typical one being the transformation of the object RC into a subject RC. In some cases, this gave rise to a misinterpretation of the task; while in some other cases, the produced subject RC preserved the intended elicited meaning. Findings of this study therefore showed a subject advantage in RC acquisition in child Italian.

Costa et al. (2011) explored the subject–object asymmetry in RC acquisition of Portuguese-speaking children. In experiment 1, they tested 60 monolingual European Portuguese speaking children, aged between 3;09 and 6;02 (mean: 5;01) by using an elicitation production task. An obvious asymmetry between subject and object relatives was seen in the results. For all age groups and for all children, subject relatives were used more appropriately than object relatives. In experiment 2, in order to assess the comprehension of subject and object RCs, the authors used an RC comprehension sentence-picture matching task. The results showed that subject

relatives were comprehended almost perfectly, with a success rate of 96%, whereas for object relatives, children only reached a 68% rate of correct interpretations.

Whereas the above studies all showed a clear and consistent subject over object advantage in the RC acquisition of European languages, the situation is more complicated in the acquisition of RCs in Asian languages. Section 2.2.6 reviews the acquisition studies of subject-object asymmetry of RCs in several East Asian languages.

2.2.6 Subject-object Asymmetry in the Acquisition of RCs in East Asian languages

When one looks beyond the commonly studied European languages, and turn to studies on East Asian languages, there are in fact increasing evidence showing that object RCs are not necessarily more difficult than subject RCs in acquisition cross-linguistically.

Ozeki and Shirai (2005) pointed out that primacy of subject RCs does not occur in the acquisition of East Asian RCs; in particular, they noted that children's early RCs in Japanese and Korean are very different from children's early RCs in English.

Ozeki & Shirai (2007b) analyzed longitudinal data from five Japanese children aged 0;00 to 3;11 and reported very different results. The results showed that SU, DO, and OBL relatives were used from the beginning of RC production at approximately the same rate (about 30%), in the order of SU (35.6%) > OBL (34.7%) > DO (27.9%), which does not show a subject advantage.

In Suzuki's (2011) picture selection experiment, Japanese-speaking children's performance was significantly better with direct object relatives (83% correct), compared to subject relatives (60.7% correct). This dominance, however, disappeared when the author only considered those children who could use nominative and accusative case markers as cues for the comprehension of single-argument sentences. The author therefore further suggested that there is no difference in the difficulty between subject and object relative clauses in children's acquisition of Japanese.

With respect to acquisition studies on Cantonese RCs, Lau (2006) studied 31 children aged 4;00 to 6;01 on their comprehension and production of RCs using an act-out task and an elicited imitation task and found an advantage in subject RCs.

However, animacy cues were not systematically controlled in the RC test stimuli, weakening the cogency of the results.

Chan et al. (2007) studied RC production by Cantonese-speaking children. They adopted the elicited imitation paradigm and asked 21 Cantonese-speaking children aged 4;03-4;09 to repeat different types of Cantonese classifier RCs, while manipulating the position of the head NP being relativized (Subject (S), Agent (A), Patient (P), Indirect Object (IO), Oblique (OBL) and Genitive (GEN)). Importantly, they neutralized the animacy cues across all the RCs. The results indicated that Cantonese children did not exhibit a subject- over object- RC advantage.

Matthews & Yip (2002) and Yip & Matthews (2007) examined the L1 acquisition of Cantonese in a bilingual context by examining diary data from their own three bilingual children, combined with the data from their Hong Kong Bilingual Child Language Corpus. The results show that, in their children's Cantonese, object relatives emerged earlier than or simultaneously with subject relatives; and in their English, prenominal RCs based on Cantonese features emerged first, followed by object relatives and then by subject relatives. The results run counter to the phenomenon of subject primacy frequently documented in English RC acquisition.

Based on HKCOLAS (Tsou et al. 2006), a standard oral language tool in Hong Kong for children aged 5;00 to 12;00, Tsou et al. (2009) conducted a picture pointing task and an elicited production task to assess children's comprehension and production of Cantonese RCs. The study found that the subject RCs are consistently harder than object RCs, which points to an object advantage.

Another study reported in Chan, Mathews & Yip (2011) examined the comprehension of subject versus object RCs in 24 Cantonese-speaking children (aged 4;03-4;09), 24 English-speaking children (aged 4;00) and 23 Mandarin-speaking children (aged 4;00) using a picture pointing task. The results indicate that English children showed a highly significant subject advantage, while Cantonese children exhibited a significant object advantage. For Mandarin-speaking children, they showed a non-significant subject advantage. These findings suggest that Cantonese-speaking children might differ from Mandarin-speaking children on the issue of subject-object asymmetry.

The acquisition studies on the issue of subject-object asymmetry in Mandarin RCs will be introduced in the following section.

2.2.7 Subject-Object Asymmetry in the Acquisition of Mandarin RCs

In Mandarin, acquisition studies addressing the issue of subject-object asymmetry show mixed findings thus far.

Lee (1992) examined 61 Mandarin-speaking children aged 4;00 to 8;00, using an act-out task to test their understanding of different types of RCs. The findings indicated a clear subject over object advantage.

In a study by Cheng (1995), an act-out task was used to test 36 preschool Mandarin speaking children on their comprehension of subject and object RCs. The results show that subject RCs are easier to interpret than object RCs. In addition, an elicited production task was conducted to examine the production of RCs of 27 Mandarin-speaking preschool children. The result was that all the children produced more subject RCs than object RCs.

The study by Hsu, Hermon & Zukowski (2009) also shows a subject advantage. In this study, an elicited production task was used to examine 23 Mandarin-speaking children (aged 4;08)'s production of RCs. One finding was that the Mandarin-speaking children, like child speakers of English, produced more errors when attempting to produce object RCs than when attempting to produce subject RCs. Another finding was that the children produced more of the expected types of correct RCs in the subject condition than in the object-gap condition. In addition, the children appeared to avoid using RCs more often and make more errors in contexts designed to elicit object RCs than in those designed to elicit subject RCs.

In addition to these studies that suggest a subject advantage, some other studies found neither a subject nor an object advantage in the acquisition and processing of Mandarin RCs.

Chang (1984) used an act-out task to test 48 preschool Mandarin-speaking children on their comprehension of subject and object RCs. Results showed no difference in the scores of accuracy between subject and object RCs, which points to neither a subject-gap nor an object-gap advantage.

In a study by Su (2004), who employed a production task with Mandarin-speaking children, there was no significant difference found in RCs produced between the subject and object types. Both younger children (aged 5;03 on average) and older children (aged 6;01 on average) were found to produce numerically more object-gap RCs than subject-gap RCs (younger children: 88% vs 84%, older children: 83% vs 78%), but the difference was not significant.

Yet, there are two recent studies pointing to an object RC advantage. One study is a large-scale elicited production study reported in a conference presentation by Ning & Liu (2009), which involved 1567 Mandarin-speaking children from Northern China aged between 2;00 and 7;00. According to the authors, the data suggest that object RCs are acquired earlier than subject RCs. Their data thus appear to point to an early object RC advantage. Very recently, Chen & Shirai (2014) reported on a longitudinal corpus study analyzing the RCs attested in child naturalistic speech (aged from 0;11 to 3;05) and adult-to-child speech. The study found that object RCs are more frequently produced than subject RCs in both children's speech and the adult input data.

Chen & Shirai (2014) is the first published study documenting the emergence and developmental trajectory of RCs in the longitudinal spontaneous production of young Mandarin-speaking children and their caregivers. This is a commendable and an important attempt, although the sample size was small with data coming from only 4 children and their caregivers, a limitation which is common among longitudinal corpus studies in acquisition. In other words, the authors are advocating for an object advantage in child Mandarin naturalistic speech on the basis of currently rather limited sample size. Given the small sample size and the mixed findings currently attested in the Mandarin acquisition literature, it is still worthwhile the efforts to revisit the issue of subject-object RC asymmetry in child Mandarin acquisition. Specifically, as an initial attempt, study 1 attempts to extend the empirical coverage of naturalistic corpus investigations, by capitalizing on a large cross-sectional Mandarin corpus in CHILDES featuring 140 Mandarin speaking children aged 3;00 to 6;00, and mother-to-child speech from the 140 mother-child pairs collected in the same corpus.

2.3 Methodology of the Current Study

This section provides a detailed description of the nature and source of the data, procedures for data analysis, and the classification criteria for classifying different types of RCs in the current study.

2.3.1 Data in the Current Study

This study examines the naturalistic data that came from the released naturalistic child Mandarin corpus called "Zhou2" deposited at the Child Language Data Exchange System (CHILDES) archive (MacWhinney 2000) (downloadable at: http://childes.psy.cmu.edu/data/EastAsian/Chinese/). CHILDES, founded in 1984, consists of a collection of manually transcribed corpora of casual verbal interactions between children and their parents. According to MacWhinney (2000), there have been more than 1000 research papers published based on the data in CHILDES. Researchers use CHILDES to examine patterns in the database, for instance, the development of specific syntactic constructions or parts of speech.

There are more than 130 corpora on different languages in the CHILDES database, six of which are on Mandarin Chinese. This study focuses on the corpus "Zhou2" in the directory "Chinese" under the "East Asian" languages. The corpus "Zhou2" was created by Zhou Jing (Eastern China Normal University) in 2007. The cross-sectional data in this corpus were collected in preschool programs in Nanjing, China. The data include utterances from 140 mother-child pairs. The children involved belong to different age groups: 3;00, 3;06, 4;00, 4;06, 5;00, 5;06 and 6;00. There are seven age groups with 20 transcribed files from 20 children within each age group.

According to the introduction of the Zhou2 corpus in CHILDES, there were some criteria used in selecting the samples. First, the children were all from Mandarin speaking families; that is, the parents speak Mandarin Chinese to their children in everyday life. Second, the parents and teachers reported no evidence of any hearing impairment or developmental delay in their children. Third, there were equal numbers of girls and boys, and as is the case in China because of the one-child policy, all the children are the first and only child in their respective families. The fourth criterion was the socioeconomic and educational background of families. These children came from four preschools located in the same area. Two preschools were at universities, one belonged to the provincial government, and one belonged to a large industrial

enterprise. The families represented a range of socioeconomic statuses within the middle-class in China, as defined by both their educational and occupational backgrounds.

The data in the corpus "Zhou2" were collected from the children with the following procedure. Mother-child pairs were brought to a laboratory that was set up as a kindergarten classroom. They videotaped each mother-child pair using a camera located in one corner of the room and operated by a remote control. The investigator was in the room but was not involved in the conversation between mother and child. There was a warm-up period at the beginning, during which the parents and children were in the room with a collection of toys and the mother was instructed to take a few minutes to let her child become accustomed to the setting. After the warm-up period, there was a semi-structured play period. The mother played with her child using the contents of four boxes. The four boxes contained: a ball for initiating interactions between mother and child; a popular toy called Transformer to encourage the child and his or her mother to talk and play together during that period; some paper and crayons for the mother and her child to use for drawing pictures and talking about them; and a picture book with stories in Chinese, for initiating communication between the mother and child through reading and talking about and discussing related topics. Parents were not instructed on how long they should spend on each box but were asked to have only one box open at a time and to try to get to all four boxes within about ten minutes. The videotaped session for each mother-child pair lasted for about 20 minutes.

2.3.2 Data Retrieval

To retrieve the data used in the current study, the program CLAN and some standard search tools (such as KWAL) were used. CLAN (Computerized Language Analysis) is one of the major CHILDES programs and is necessary in this study in reading and analyzing the data in the Zhou2 corpus (which can be downloaded at http://childes.psy.cmu.edu/clan/). After running CLAN with the standard research tool KWAL, it is possible to retrieve all the utterances needed from the corpus.

The studies in this dissertation focus on noun-modifying constructions (NMCs) in child Mandarin. In the literature, one viewpoint holds that the Chinese attributive NP (noun phrase) with 的 *de* is different from the counterpart without *de* and that

they should be treated differently. Lü (1979:P24) remarked that in Mandarin, the construction of "attributive + *de* + head noun" (such as 大的树 *da de shu* 'big tree') is different from that of "attributive + head noun" which is *de*-less (such as 大树 *da shu* 'big tree'); therefore, the two constructions should not be considered as identical. Likewise, Shi (2011) proposed that in Mandarin, the attributive NP like 白的纸 *bai de zhi* 'white paper' is a phrase, while the attributive NP like 白纸 *bai zhi* 'white paper' is a compound word. Sun (2012) also proposed that 我的爸爸 *wo de baba* 'my father' is semantically and pragmatically different from 我爸爸 *wo baba* 'my father'. The current study adopts the analysis that "attributive + *de* + head noun" is different from "attributive + head noun" and delimits the scope of the study to only NMCs that include the *de* marker.

As such, for retrieving all the NMCs, the commands "kwal +s'的' +t*CHI *.cha" and "kwal +s'的' +t*MOT *.cha" were used to search the relevant lines spoken by children and adults respectively. This resulted in 5026 phrases with 的 *de* being retrieved from 276 files featuring 135 mother-child pairs[1]. The output files were converted into Microsoft Excel format for further manual coding and disambiguation.

Within these 5026 phrases, there were 734 subject-extracted and object-extracted RCs, where the modifier is a clause and the head noun plays the subject or direct object role in the modifying clause. Within these 734 RCs, 120 RCs were produced by children and 614 RCs produced by the mothers.

2.3.3 Data Analysis

As this study focuses on the use of subject RCs versus object RCs, an important step is to code the 734 RCs into these two different types. The head nouns of these RCs are either (1) co-referent with the gap in the subject position of the clause (subject RCs, see example (10a)) or (2) co-referent with the gap in the object position of the clause (object RCs, see example (10b)).

(10) a. 一只 会 飞 的 天鹅 (Subject RC)
yi zhi hui fei de tian'e
one CL can fly DE swan

[1] Four files from two mother-child pairs were found to be repetitive and therefore discarded.

'a swan that can fly'

b. 宝宝　喜欢　吃 的 东西　(Object RC)
baobao xihuan chi de dongxi
baby like eat DE thing
'the things that baby likes to eat'

2.4 Results

Table 2.2 below lists the distribution of subject RCs and object RCs in child output and adult input from the seven age groups between ages 3;00 and 6;00.

Table 2.2: Distribution of the Subject RCs and Object RCs in Children's Output and Adult's Input at Different Ages

Speaker	Age	Subject RC		Object RC	
		Token (Type[3])	Token (Type)%	Token (Type)	Token (Type)%
Child	3;00 (7[1]/20[2])	4 (4)	33.33 (33.33)	8 (8)	66.67 (66.67)
	3;06 (6/21)	2 (2)	28.57 (28.57)	5 (5)	71.43 (71.43)
	4;00 (9/16)	9 (8)	45.00 (44.44)	11 (10)	55.00 (55.56)
	4;06 (9/19)	5 (5)	41.67 (41.67)	7 (7)	58.33 (58.33)
	5;00 (12/22)	7 (7)	35.00 (35.00)	13 (13)	65.00 (65.00)
	5;06 (9/16)	8 (5)	29.63 (23.81)	19 (16)	70.37 (76.19)
	6;00 (8/21)	4 (4)	18.18 (20.00)	18 (16)	81.82 (80.00)
Adult	3;00 (17/20)	32 (26)	38.55 (37.14)	51 (44)	61.45 (62.86)
	3;06 (20/21)	21 (21)	21.43 (28.38)	77 (53)	78.56 (71.62)
	4;00 (15/16)	23 (20)	27.38 (28.57)	61 (50)	72.62 (71.43)
	4;06 (17/19)	21 (18)	22.11 (24.66)	74 (55)	77.89 (75.34)
	5;00 (21/22)	18 (15)	20.45 (25.00)	70 (45)	79.55 (75.00)
	5;06 (16/16)	12 (6)	17.14 (21.43)	58 (22)	82.86 (78.57)
	6;00 (20/21)	24 (17)	25.00 (29.31)	72 (41)	75.00 (70.69)

[1] The first number indicates the number of children or adults in this group who produced at least one token of RC in the language samples.
[2] The second number indicates the number of children or adults in this group.
[3] The RCs were regarded as different types when there is at least one constituent being different between the RC tokens.

Results indicate that there are significant differences in the distribution of subject RCs and object RCs [x2=16.363, df=1, p=.000 Chi-square test[2]] in child naturalistic speech. Post hoc analyses show that except for the groups of age 4;00 and 4;06, where the differences did not reach statistical significance (though the data still indicate more object RCs than subject RCs attested by type and token measures), the other age groups all show significantly higher frequency of usage of object RCs than subject

[2] Analysis is based on token measures. Analyses based on type measures yield the same pattern of results.

RCs. In addition, an analysis based on type measures found a similar result. Figure 2.2 illustrates the production trend of children's subject RCs and object RCs across age groups.

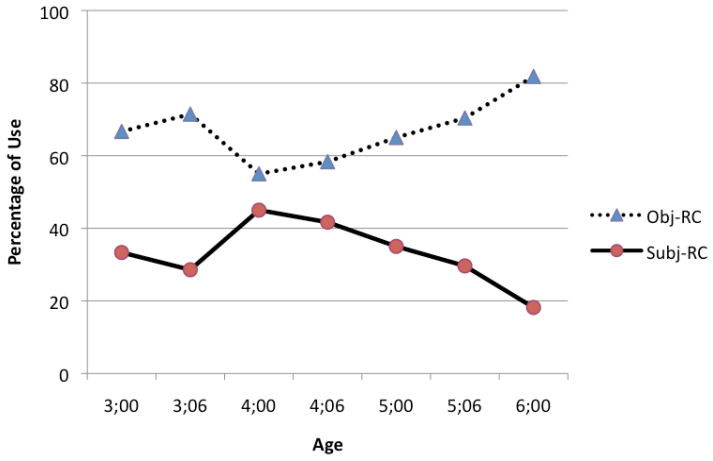


Figure 2.2: Distribution of Subject RCs and Object RCs in Child Output

Likewise, the adult input data also indicate that there are significant differences between the use of subject and object RCs [x2=139.102, df=1, p=.000 Chi-square test[2]]. Specifically, adults used more object RCs than subject RCs in their child directed speech. Post hoc analyses show that except for the 3;00 age group (though the data still indicate more object RCs than subject RCs attested by type and token measures), the other age groups all show significantly higher frequency of usage of object RCs than subject RCs. Figure 2.3 illustrates the production trend of adults' subject RCs and object RCs in each age group.

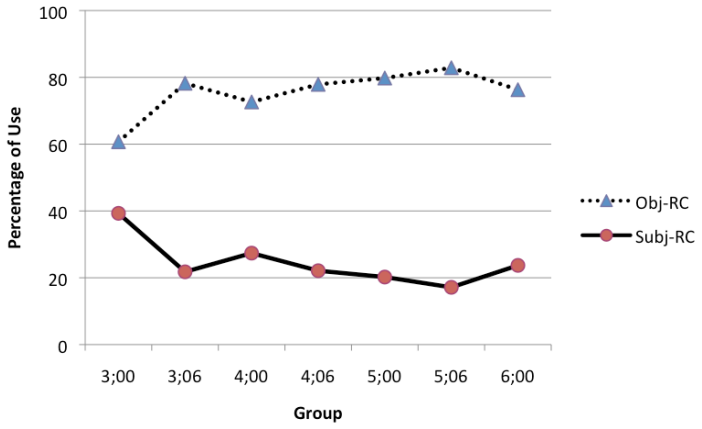


Figure 2.3: Distribution of Subject RCs and Object RCs in Adult Input

In addition to the illustration of children's production of RCs, Figure 2.4 describes the distribution of the percentage of children who produced at least one subject or object RC in their language sample. The figure shows that the percentage of children who produced at least one object RC is consistently higher than those producing at least one subject RC in each age group. This pattern is consistent with the pattern obtained from the percentage of use of child RCs.

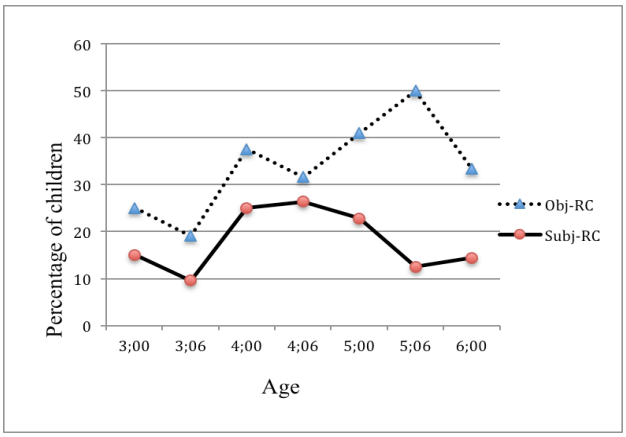


Figure 2.4 Percentage of Children Producing at least One subject/object RC in Each Group

Taken together the results, the data suggest that object RCs are acquired earlier than subject RCs in child Mandarin.

In addition, Figure 2.4 shows that more and more children produced at least one object RC in their language samples as age increases. This finding suggests a developmental progression rather than reflecting the distributional usage of RCs in different age groups.

2.5 Discussion

Similar to Chen & Shirai (2014), results show a clear object RC advantage over subject RCs across age groups in both child naturalistic speech and adult child-directed speech. These results are consistent with the prediction of theories considering surface sentence structure (linear distance and canonical word order). The acquisition findings are also consistent with the input properties. There is no subject primacy as predicted by theories considering hierarchical sentence structure and NPAH.

These findings run counter to the phenomenon of a clear subject primacy in the acquisition of RCs in some European languages (e.g. Diessel & Tomasello 2000;

2005; and review by Hsu et al 2009). Rather, the results align with the findings of quite a number of acquisition studies on East Asian languages, which do not indicate a clear subject primacy (e.g. Ozeki & Shirai 2007 and Suzuki 2011 for Japanese), with some studies even pointing to an object advantage (e.g. Ning & Liu 2009 and Chen & Shirai 2014 for Mandarin; Matthews & Yip 2002, Yip & Matthews 2007, Tsou et al. 2009 and Chan et al. 2011 for Cantonese). The distinct acquisition patterns between these European languages and Asian languages are consistent with the distinction of RC language versus attributive clause language in Comrie's typology: RCs between these language types are qualitatively different (see chapter 3 for further elaborations). Chen & Shirai (2014) further elaborated and accounted for these typological variations, and hypothesized that for those "RC European" languages, there is a robust subject over object advantage because the weight of structural reasons as a predictive factor of RC acquisition is very strong (in terms of the formal complexity involved in relativizing the different syntactic positions, as reflected by the NPAH). In contrast, in those "attributive clause Asian languages", multiple factors jointly determine the order/ease of acquisition, which include input frequency and similarity to simple sentences on which RCs are built. The current corpus findings are consistent with Chen & Shirai (2014)'s hypothesis: there is an object advantage in the acquisition of RCs in Mandarin, which is one representative example of an attributive clause language in Comrie's typology, due to the similarity of direct object RCs with simple SVO transitives, in addition to the influence of input frequency.

In light of the current mixed findings in the acquisition literature of Mandarin RCs, then, we seem to observe a discrepancy between naturalistic corpus findings and experimental findings here. Whereas the corpus findings indicate that Mandarin children produce object RCs earlier and more than subject RCs in their spontaneous speech; some experimental production findings reported in, for instance, Hsu et al (2009) showed a subject advantage.

Why different methods/studies, different findings? How to explain such discrepancy between naturalistic corpus findings and experimental findings? Data sampling in conducting naturalistic corpus studies is an issue one needs to pay attention to. Although it is reasonable to assume that when a construction is frequently encountered and used, it may also be easier and earlier to acquire for a language learner, notions of frequency, primacy, preference and ease of acquisition

may not always align with one another, especially when one would like to determine the order of acquisition between two constructions that differ quite a lot in their frequency of use.

This relates to whether the order of emergence between the two constructions that we see in the language samples accurately reflect the actual order of acquisition between the two constructions, and how does order of emergence in the samples relates to frequency of use of each construction. Tomasello and Stahl (2004) raised the important methodological issue that the order of emergence that we see in language samples may not accurately reflect the actual order of acquisition when two constructions differ quite a lot in their frequency of use. For example here, if subject RC is a lower frequency construction and object RC is a higher frequency construction (because there are pragmatic reasons or having more opportunities for higher use of object relatives, as has often been suggested by functional linguists), and in actual order of acquisition, subject RC is actually acquired alongside or even earlier than object RC, in the children's language samples however subject RC may be attested later than object RC. This is because since subject RC is not frequently used, it becomes less likely that in language sampling we can catch an exemplar of subject RC used by the child ***right after*** the child actually started using it, unless we use very dense sampling of the child's language.

If this is so, these mismatches may underlie the contrasting findings between corpus findings and experimental findings, that is, we find object advantage in children's naturalistic speech but we find subject advantage in elicited production experiment in Hsu et al (2009). In fact, in a very recent study by Hsu (2014), the first RCs attested in the naturalistic child speech corpus data were object RCs for most children (5 out of 8 children, p.35) while subject advantage in the production experiment was noted and emerged only between age 4 and 5 (p.39-40).

On the other hand, it is important to note that Hsu et al (2009) included both intransitive and transitive verbs in their subject RC sentence stimuli. They did not report a direct comparison between subject transitive RCs and direct object transitive RCs. As subject intransitive RC sentence stimuli are structurally simpler, one might wonder whether merging both subject intransitive and subject transitive RC stimuli in one single "subject RC condition" might give rise to an apparent advantage for the

subject RC condition. As future research, we need an elicited production study similar to Hsu et al (2009) but directly compare between subject transitive RCs and direct object transitive RCs. Even more ideal would be to collect longitudinal naturalistic speech data from the same subjects to directly compare between naturalistic speech data and experimental production data.

2.6 Concluding Remarks

This study documents new empirical evidence in support of an object primacy in RC acquisition in young Mandarin-speaking children's naturalistic speech and adult-to-child input. The current findings based on a much larger sample size at a comparatively later age strengthen the empirical claims reported in Chen & Shirai (2014) that object RCs are used more frequently than subject RCs in both child naturalistic speech and adult-to-child input. Taken these two corpus studies together, it is reasonable to make the remarks that (i) direct object relatives emerge early and remain to be more frequently used than subject RCs in child Mandarin naturalistic speech; (ii) direct object relatives are also more frequently used than subject relatives in adult Mandarin child-directed speech, when caregivers speak to their Mandarin-speaking children throughout the preschool years. This evidence is robustly attested across the two studies.

Chapter Three

Semantic Relations between Modifier and Head Noun of Mandarin Noun-Modifying Constructions: Child Naturalistic Speech and Adult Input

3.1 Introduction

Study 1 introduced in Chapter Two focuses on the use of Mandarin relative clauses (RCs). In typology, RCs in certain Asian languages - such as Japanese, Korean and Chinese - have recently taken on new theoretical significance. Noun-modifying clauses (NMCs) in these Asian languages are structurally different from RCs in European languages (Matsumoto 1988; Comrie 1996) and should be treated as attributive clauses rather than European-type RCs, In these Asian languages, RCs can be considered a subset of NMCs involving no syntactic operation such as gap-filling or movement (Comrie 1996, 1998, 2002).

NMCs are a single class of constructions, in which a noun or a noun phrase is modified by an adnominal subordinate clause to form a complex noun phrase (Matsumoto 1997). Because of the complexity of the structure and the frequent and extensive uses within and across languages, it has been one of the central issues in linguistic research.

Much research on NMCs is based on English and other European languages. Since the 1980's, a new typology on NMCs was proposed. According to Matsumoto (1988, 1997) and Comrie (1996, 1998, 2002), NMCs in many Asian languages can be treated as simply attaching a modifying clause to the head noun, and the two parts of NMCs (modifying clause and the head noun) are connected not by grammatical or syntactic relations but by semantic and pragmatic factors.

Mandarin Chinese has a productive NMC in which a noun is modified by a clause without there being a grammatical relation between the clause and the head noun. For example, in the Mandarin examples (1) and (2), the head nouns 'shoes' and 'sound' are not strictly arguments of the verbs 'go (to school)' and 'play', but are associated with the modifying clauses semantically and pragmatically.

(1) 上学　　的 鞋子
shangxue de xiezi
go to school DE shoes
'The shoes for going to school'

(2) 弹　钢琴　的 声音
tan gangqin de shengyin
play piano DE sound
'The sound from playing the piano'

It proves difficult, if not impossible, to separate NMCs such as (1) and (2) from those 'conventional' RCs such as (3) and (4) below (Comrie 1996, 1998, 2002).

(3)　我 买 的 鞋子
wo mai de xiezi
I buy DE shoes
'The shoes that I have bought'

(4)　我 听到　的 声音
wo tingdao de shengyin
I hear DE noise
'The sound that I have heard'

Under this alternative view, Mandarin Chinese does not have syntactic RCs distinct from other NMCs, such as (1) and (2). Rather, the language has a general NMC for attaching modifying clauses to head nouns based on semantic-pragmatic relations between the two constituents. This construction has a range of interpretations which can be characterized as relative clause interpretations, or complement clause interpretations, or some kind of modifying clause interpretations (see also Huang 2008). As such, Mandarin RCs can be analyzed as a subset of NMCs in which a modifying clause is attached to the head noun based on semantic-pragmatic relations.

If this is so, analysis of Mandarin NMCs calls for an approach that recognizes the role of semantics and pragmatics that account for the processing and acquisition of these constructions. Generative Lexicon (GL) Theory (Pustejovsky 1995) has become one of the most influential theories in semantics, and qualia structure is a central framework in the GL theory. The GL Theory provides an explanatory model for capturing the qualia modification relations in the semantic composition within a compound (Lenci et al. 2000). Similarly, Chinese NMCs are composed of a modifier and a head noun. It can be deduced that qualia modification relations also exist between the modifiers and the heads of Chinese NMCs. Given this, study 2 attempts

to use qualia structure relations as a framework to characterize the semantic relations between the modifier and the head noun of NMCs.

The current study adopts the typological perspectives on NMCs proposed by Comrie (1996, 1998, 2002), Matsumoto (1988, 1997) and Chen & Shirai (2014). The study investigates the types and the developmental trajectory of NMCs, in the form of [Modifier + *de* + (Noun)], attested in Mandarin-speaking children's speech from a semantic perspective based on the generative lexicon framework (Pustejovsky 1995). Based on 850 NMCs (including those traditionally defined as RCs) produced by 135 children aged 3 to 6 from a cross-sectional naturalistic speech corpus "Zhou2" in CHILDES and 2699 NMCs attested in the mother-to-child speech in the same corpus, this study analyzes the relation between the modifier and the head noun according to the four major roles of qualia structure: formal, constitutive, agentive and telic.

This chapter is organized as follows. Section 3.2 reviews the relevant research on NMCs and GL theory; Section 3.3 describes the methodology used; Section 3.4 presents the results; Section 3.5 offers a general discussion of the major findings; and Section 3.6 states the concluding remarks.

3.2 Literature Review

3.2.1 Noun-modifying Clauses (NMCs) in East Asian Languages

3.2.1.1 NMCs in Japanese

Matsumoto (1997, 2007) developed a framework to account for NMCs in Japanese, building on ideas in existing works on frame semantics (e.g., Fillmore 1977, 1982; Fillmore & Atkins 1992). Under this frame semantic analysis of NMCs in Japanese, the construal of NMCs is described in terms of 'the relation between the concept denoted by one of the constituents of the construction (i.e., the modifying clause or the head noun) and the frame evoked by the other' (Matsumoto 1997: 166). In addition, how a specific interpretation of the construction is determined depends on the construer's world-views regarding contextual information and cultural knowledge (Matsumoto 1997: 166-167; 2007: 132). It is suggested in Matsumoto (2007) that future research could apply a similar framework to consider the acquisition and processing of other NMCs from a semantic-pragmatic approach.

In light of Matsumoto (1997), there are various forms of clausal noun modifications in English, such as modification by a finite, infinitival, gerundive, or

participle clause (i.e., *the book which the student bought*, *things to do*, *the result of skipping breakfast*, and *burnt toast*). These modification constructions correspond to a single form of constructions in Japanese, with the head noun modified by a clause in finite form. They are named as noun-modifying constructions (NMCs) in Matsumoto (1997). Japanese NMCs include what are usually referred to as "relative clauses" and "noun complements" which are defined syntactically. These two particular types can be illustrated by the examples (5) and (6), respectively. In (5), there is a reference-binding relationship between the head noun "*person*" and a syntactic gap in the modifying clause "*I met Ø*". In (6), there is no a so-called clause-internal gap.

(5) [watasi ga kinoo atta] hito
I NOM yesterday met person
'The person whom I met yesterday'

(6) [tikyuu ga marui] zizitu
earth NOM round fact
'The fact that the earth is round'

According to Matsumoto (1988, 1997), the term "noun-modifying clauses" can cover much broader modification relationships than RCs in European languages. They can express not only what standard European RCs can (e.g., *the boy who came*; *the house where he was born*) but also appositive relationships (e.g., *the news that he died*) by using the same construction. Furthermore, they can also express loose semantic relationships, such as in (7):

(7) [kookoo nyuusi-ni zettai ukaru] katei-kyoosi
high school entrance exam-DAT absolutely pass tutor
'A tutor (because of whose assistance) (the student) can be sure to pass the high school entrance exam'

(Matsumoto 1997: p 95)

This sentence will be interpreted as a SU relative (i.e., *the tutor who definitely passes the high school entrance exam*) based on the syntactic interpretation; however, pragmatic knowledge indicates that it is not the tutor who passes the entrance exam but the students taught by the tutor. Native Japanese speakers have no trouble in interpreting this kind of sentences. These examples show that the formation and construal of NMCs in Japanese are not reliant on the existence of syntactic gaps. Rather, an explanation based on semantic and pragmatic factors rather than syntactic conditions can determine the availability and construal of noun-modifying clauses in Japanese (Matsumoto, 1988, 1997, 2007).

Matsumoto (1997, 2007) demonstrated that a purely syntactic analysis modeled on analyses of English relative clauses cannot account for Japanese NMCs, and that semantics and pragmatics play a crucial role in licensing NMCs in Japanese. She therefore attempted to propose a "gapless" approach to account for a wide range of NMCs in Japanese. The proposed framework involves both semantic *frames* evoked by linguistic clues given in the constructions and construers' expectations based on their world-view.

Matsumoto (1997, 2007) proposed that Japanese NMCs are well-formed if the head noun can fit in a frame or scene which is evoked by the modifying clause. In this approach, the frame is available by semantic and pragmatic factors like worldview, background knowledge and presupposition. For example, in (8) below, the head noun *terebi* (interpreted in this context as 'watching a TV program') fits in the frame evoked by the content of the modifying clause, which means "one's energy will rise". Examples such as (8) reveal characteristic features of Japanese that cannot be adequately accounted for without reference to semantics and pragmatics.

(8) [genki no deru] terebi
energy Gen rise television
'A TV program by watching which one's energy will rise'

Under this analysis (Matsumoto 1997, 2007), every instance of NMC has its own frame and participant roles. There appears to be no general rule or guideline for predicting what frames will be available for the construction. The appropriate frame seems to be available on a case-by-case basis.

3.2.1.2 NMCs in Korean

Similar to Matsumoto (1988), Yoon (1993) proposed explaining RCs in Korean from a semantic perspective. He suggested that the existence of a gap in the RC is not relevant at all in explaining any type of RC constructions in Korean, including argument and adjunct gap RC constructions. In his approach, RC constructions are legitimate only if a semantic relation ("R-relation" in his terminology), as exemplified in (9), holds between the RC and the head noun. According to his analysis, it is possible that an explanation of Korean RC constructions can have nothing to do with the existence of a syntactic gap of any kind.

(9) Possible R-relations
agent, theme, location, source, goal, time, instrument, reason, cause, beneficiary, result, sign, method, topic, part-whole, etc.

As an illustrative example, NMC like (10) is legitimate, because a cause relation holds, between the referent of *naymsay* ("smell"), represented by the head noun, and the state of affairs represented by the modifying clause *sayngsen-i tha* ("fish burns"). It is further required that the state of affairs is supported by an appropriate situation.

(10) [sayngsen -i tha-nun] naymsay
fish – Nom burn-Adn smell
'The smell (that is caused) from fish burning'

3.2.1.3 NMCs in Asian Languages (Comrie 1996, 1998, 2002)

Based on the work of Matsumoto (1988), Comrie (1996, 1998, 2002) proposed rethinking the typology of RCs that distinguishes RCs in Japanese and other Asian languages with similar properties from RCs in European-type languages. Based on the observation that the relationship between the head noun and the modifying clause is constrained not by grammatical relations but by semantic and pragmatic factors in some Asian languages, Comrie proposed that RCs in Asian languages such as Japanese, Chinese and Korean are qualitatively different from those in European languages and should be treated as attributive clauses rather than European-type RCs. These constructions involve simply attaching modifying clauses to the head noun based on semantic-pragmatic relations. The putative "RCs" in certain Asian languages such as Japanese, are merely a type of general noun-modifying constructions.

Comrie (2002) argued that because Japanese allows *pro* in the language in general, one can argue that there is a *pro* in (11) in the position where one would normally expect a gap of movement in an RC construction. Without a "true" gap in the subordinate clause, sentence like (11) is "pretty much what we see on the surface: a head noun *hon* 'book' modified by a clause *gakusei ga katta* 'the student bought [it]' " (Comrie 2002: 30). Also, (11) would then be structurally and functionally similar to other noun-modifying constructions in the language such as (12) and (13), where the head noun does not play a syntactic role in the modifying clause, hence there can not be any syntactic gap of movement or extraction in these instances. The semantic relationship between the modifying clause and the head noun is subject to pragmatic inference.

(11) [[Gakusei ga katta pro] hon]
Student NOM bought pro book
'The book that the student bought'

(12) [gakusei ga hon o katta] zizitu
student NOM book ACC bought fact
'The fact that the student bought the book'

(13) [dareka ga doa o tataku] oto
someone NOM door ACC knock sound
'The sound of someone knocking at the door'

This proposal is in some way similar to Fukui & Takano (2000)'s argument that Japanese RCs are licensed by an "aboutness" relation between the RC and the head noun. This analysis is consistent with the idea that there is no operator movement or head raising in Japanese relative clauses, and that gapless "RCs" are possible.

Similarly, some acquisition studies in Asian languages such as Korean and Cantonese refer to this proposal in suggesting that these European-type RCs may not exist in these Asian languages (Ozeki & Shirai 2007c; Yip & Matthews 2007). These languages share those key features as in Japanese, for instance, also being null-anaphor languages, and having other instances of a head noun accompanied by a modifying clause that cannot be treated as instances of " conventional" relative clauses with a gap.

3.2.2 Nominal Phrases in Mandarin Chinese

Nominal phrases in Mandarin have a basic structure: the head is always placed final and is filled with a simple noun or a compound noun. The other important positions in nominal phrases are the modifier, the determiner (DET), the number (NUM), and the classifier (CL) (Shi 2011). Various combinations of the modifier are possible and three basic and common ones are shown below in (14a-c).

(14) a. 那 本 书
na ben shu
that CL book
'That book'

b. 两 本 书
liang ben shu
two CL book
'Two books'

c. 那　两 本　书
　na liang ben shu
　those two CL book
　‘Those two books’

The modifier of a nominal element can also be either words or phrases (e.g., nouns; pronouns; verbs; or phrases including a verb) marked with *de*, formulated as (15). In this form, modifiers precede the head noun and the noun phrases have the particle *de* functioning as a marker of attributives.

(15) modifier + *de* + head noun

Table 3.1 contains examples of complex noun phrases with different types of modifiers.

Table 3.1 Examples of Noun Phrases with Different Types of Modifiers in Mandarin

Modifiers	Noun Phrases
Noun	(16) 孩子 的 衣服 haizi de yifu child DE clothes ‘Child’s clothes’
Pronoun	(17) 他 的 家 ta de jia he DE home ‘His home’
Adjective	(18) 昂贵 的 车 anggui de che expensive DE car ‘Expensive car’
Verb (V)	(19) 写 的 字 xie de zi write DE character ‘The character that is written word’
Verb + Object (VO)	(20) 唱　流行歌　的 女孩儿 chang liuxing ge de nvhair sing pop song DE girl ‘The girl singing pop music’
Prepositional Phrase + Verb (PPV)	(21) 从 日本 来 的 学生 cong riben lai de xuesheng from Japan come DE student ‘Student from Japan’
Subject + Verb (SV)	(22) 他 喜欢 的 东西 ta xihuan de dongxi he like DE thing ‘The things that he likes’
Whole Clause (SVO)	(23) 我 买 书　的 事情 wo mai shu de shiqing I buy book DE fact ‘The fact that I bought books’

When the modifier is a noun, as in (16), the head of the modifier NP can be further modified, as shown in (24):

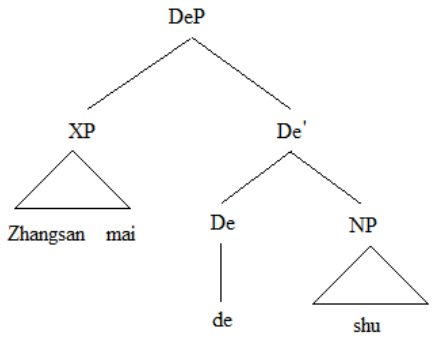
(24) 新 书 的 内容
xin shu de neirong
new book DE content
'The content of the new book'

As for the examples in (19) - (23), they can be further categorized as "VP + *de* + head noun", in which the VP can have the form of V, VO, PPV, SV or SVO.

Examples (19) - (23) are often analyzed as Chinese relative clauses (RCs). There are some special features of them. First, the modifier may be a bare verb with two missing arguments in which there is a gap co-indexed with the head, like the one in (19). Second, the modifier may be a clause with an adverbial of instrument or location and with a missing argument, as (21) shows. Third, it is also possible for the head noun not to refer to any element in the VP like the one in (23). This possibility is referred to as Fact-S Structure by Comrie (1996).

Within these *de* constructions, some studies treat components preceding *de* as an attributive clause, which functions as the modifier of the components after *de* (Huang 1982; Ning 1993, 1996; Wen 1996). Some research treats *de* construction as a DP, within which the components preceding *de* combine with *de* and then attach to and modify the components after *de* (Li 2001; Aoun & Li 2003). Some other research treats *de* as the head, with NP as its complement and XP as its specifier, like in (25) (Si, 2004):

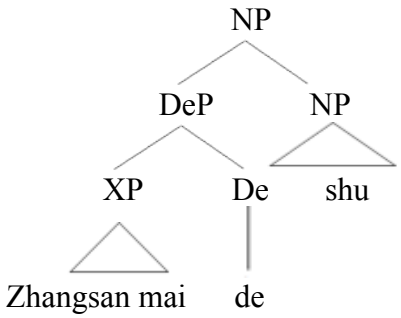
(25)



Zhangsan bought DE book
'The book which Zhangsan bought'

Shi (2008) proposed that NP should be the head of NP and DeP is only an adjunct of a NP. *de* is the head of DeP, with XP as its complement, as shown in (26):

(26)



Zhangsan bought DE book
'The book which Zhangsan bought'

No matter what labels are assigned to the components within Mandarin *de* constructions, there is a consensus that Mandarin *de* constructions have a structure of "XP *de* NP", in which NP is the head of the phrase, "XP" is the modifier, and there exists a modifier-modifiee relationship between the two parts.

3.2.3 RCs as NMCs in Mandarin Chinese

Comrie (2002) suggested that true relative clauses may not exist at all in Japanese and other Asian languages and that the structure can be analyzed as a type of attributive clause in those languages. RCs in Mandarin Chinese have many similarities with those in Japanese, and separating Mandarin RCs from noun-modifying (attributive) clauses as a distinct construction appears to be difficult.

3.2.3.1 Similarity between Mandarin RCs and Japanese RCs

Japanese and Mandarin RCs share a number of characteristics. For instance, both languages place the modifying clause before the head noun. In addition, the modifying clause lacks an overt marker indicating the grammatical relation between the modifying clause and the head noun.

According to Matsumoto (1997), there are two types of NMCs in Japanese: one usually referred to as "relative clauses" and the other as "noun complements". These two types can be illustrated by examples (27) and (28), respectively. Example (27) can be characterized as involving a head noun extracted from an argument position of a verb in the modifying clause. In example (28), however, the head noun cannot be syntactically extracted from a position inside the modifying clause but is only semantically and/or pragmatically licensed. These two types of NMCs shown in (27) and (28) are highly similar in structure in Japanese. Similarly, the Mandarin

counterparts of (27) and (28) also share this structural parallel between a conventional RC and a noun complement clause within the language with respect to both structure and interpretation.

(27) Japanese:
[Hon - o kat-ta] gakusei
book -ACC buy-PAST student

Mandarin:
买了 书 的 学生
[Mai-le shu de] xuesheng
buy-PAST book DE student

'The student who bought the book'

(28) Japanese:
[Tokyo-e iku] keikaku
Tokyo-ALL go-NONPAST plan

Mandarin:
去 东京 的 计划
[Qu Dongjing de] jihua
go-NONPAST Tokyo DE plan

'The plan of going to Tokyo'

3.2.3.2 NMCs and RCs in Mandarin Chinese

The concept of RC did not seem to exist in traditional Chinese linguistics in the 1960s to 1970s. Constructions including [NP *de*], [Adj *de*] and [VP *de*] before a head noun were regarded as "attributives", i.e., general modifiers of the N (Zhu 1966; Ross 1983).

As Comrie (1996) suggested, in European languages like English, subordinate clauses are clearly divided into two types: relative clause (RC) construction and noun complement clause (NCC) construction, exemplified in (29a) and (29b) respectively.

(29) a. the student [whom I praised]
b. the fact [that I praised the student]

There are some differences between the two constructions. For example, the presence of a relative pronoun (*wh*-word) can be optional in the RC construction but

is obligatory in the NCC construction. Furthermore, the adnominal clause has a syntactic gap in the RC construction but in the NCC construction it does not.

However, there are no such clear distinctions in Mandarin Chinese as in English. As shown in (30a-b), the Chinese counterparts of (29a-b), although the difference between the two constructions seems to be whether there exists a gap in the modifying clause, we cannot find any formal distinction between them. There is no relative pronoun or complementizer between the clause and the head noun. Rather, the verbs in both relative clauses and noun complement clauses take an adnominal marker *de* that is the same in the two constructions. It is difficult to formally distinguish between a RC construction and a NCC construction in Mandarin.

(30) a. 我 表扬 的 学生
[Wo biaoyang de] xuesheng
I praise DE student
'The student whom I praised'

b. 我 表扬 学生 的 事实
[Wo biaoyang xuesheng de] shishi
I praise student DE fact
'The fact that I praised the student'

Comrie (1996, 1998, 2002) proposed that quite a number of Asian languages have attributive clauses of which RCs are merely a subset. RCs in these Asian languages are qualitatively different from those in European languages.

First, these languages allow the attributive modifier to be a clause in which the head noun does not need to take a grammatical role. Instead, the modifying clause can be more loosely associated with the head noun based on semantic and pragmatic relations, see (31) in Japanese, (32) in Cantonese and (33) in Mandarin:

(31) Japanese: [dereka ga doa o tataku] oto
Someone NOM dor ACC knock sound
'The noise of someone knocking at the door'

(32) Cantonese: [lei waat- syut] go di soeng
you slide-snow DEM CL pictures
'The pictures of you skiing'

(33) Mandarin: 露露 弹 钢琴 的 声音
[Lulu tan gangqin de] shengyin
Lulu play piano DE sound
'The sound from Lulu's playing a piano'

Second, Comrie (1998) proposed that attributive clauses involve no extraction and there is no filler-gap dependency in these languages. In the case of attributive clauses such as (31-33), the head noun has no grammatical relation with the modifying clause, there is clearly no gap and no filler-gap dependency arises. There is simply a head noun and a clause modifying it.

Similarly, Tsai (2008) also showed the view that Chinese relatives, like Japanese relatives, are indistinguishable from sentential modifiers in complex NPs. In general, the modification relation between the relative clause and the head noun is very loose in Chinese. In addition, the structure of the "gapless" relative clauses (as in 34) is parallel to the complex noun phrases with adjectival modifiers (as in 35).

(34) 关门　　的　声音
[guanmen de] shengyin
close door DE sound
'The sound of closing door'

(35) 瓷　　的 花瓶
ci　　de huaping
porcelain DE vase
'Porcelain vase'

Furthermore, as Table 3.1 shows, although all the examples there have the same surface structure (i.e., modifier + *de* + head noun), there are different types of modifiers in Mandarin complex noun phrases (not only VP, but also NP and AP). Thus, the modifiers in Mandarin complex noun phrases are not limited to "clauses". As such, the scope of investigation in the current dissertation will cover all these noun phrases with different types of clausal and non-clausal modifiers, termed collectively as noun-modifying constructions here, which are broader in scope than the noun modifying clauses in Matsumoto (1997).

In brief, Mandarin Chinese and some other Asian languages, such as Japanese and Korean, do not have a syntactic RC distinct from other NMCs. Rather, these languages have a general NMC for attaching modifiers to head nouns based on semantic-pragmatic relations between the two constituents, As such, RCs in Mandarin Chinese can be analyzed as a subset of NMCs in which a modifier is attached to the head noun based on semantic-pragmatic relations.

If this is so, Mandarin NMCs call for an approach that recognizes the role of semantics and pragmatics in accounting for the processing and acquisition of the constructions.

In fact, there are some studies starting to analyze Chinese relatives from a semantic point of view.

Tsai (1992) proposed an analysis on "gapless" relatives. According to Tsai (1992), the "aboutness" relationship can be characterized as a semantic licensor to the RC and the head noun. No gap can be found in "sloppy relatives". The suggestion he made then is that in a "sloppy relative", such as (36), it is an implicit event argument that is relativized, and it is represented by the "aboutness" relationship *pro*.

(36) 阿Q 弹 钢琴 的 声音
[*pro*$_i$ [a Q tan gangqin de] shengyin$_i$]
a Q play piano DE sound
'The sound which (is produced by) Akiu's playing piano'

In the study of Ning (1993), the analysis assumed that some NP heads are linked to a resultative VP with the meaning of an empty verb "obtain". For example in (37a), the sentence is ungrammatical because the meaning of the head noun "bill" can not be "obtained" from the event "selling the car" that is stated in the modifying clause. While in (37b), the sentence is acceptable because the head noun "money" can be "obtained" from the event "selling the car" that is stated in the clause.

(37) a. * 他 卖 车 的 帐
*[ta mai che de] [zhang]
he sell car DE bill
*'The bill he (paid) by selling the car'

b. 他 卖 车 的 钱
[ta mai che de] [qian]
he sell car DE money
'The money he (obtained) by selling the car'

It can be seen that both "aboutness" *pro* and "obtain" empty verb are no longer of a pure syntactic analysis, within which there are some semantic elements.

In addition, consider the following examples in (38)-(39):

(38) a. [咬死 猎人 的] 狗
[yaosi lieren de] gou
kill hunter DE dog
'The dog which killed the hunter'

b. 咬死 [猎人 的 狗]
yaosi [lieren de gou]
kill hunter DE dog
'Hunter's dog was killed.'

(39) a. [咬死 猎人 的] 狼
[yaosi lieren de] lang
kill hunter DE wolf
'The wolf which killed the hunter'

b. ?? 咬死 [猎人 的 狼]
?? yaosi [lieren de lang]
kill hunter DE wolf
??'Hunter's wolf was killed.'

(38a) and (39a) are structurally identical in terms of having the same type of "gap" position. But (38) is easily ambiguous, while (39) is not. Under a semantic analysis, both the "dog" and the "wolf" have the characteristic of being able to "bite", but the "dog" has an additional characteristic of "domestic". Because of the semantic difference, the two sentences (38 and 39) can have different readings.

The studies and analyses above suggested that the analysis of Mandarin RCs or NMCs at large cannot disregard semantic analysis, whether they are gapped or gapless. Mandarin RCs are typologically similar to Japanese RCs, in terms of also being able to be analyzed as involving a head noun being attached to a preceding modifying clause based on semantic-pragmatic relations, forming a subset of a general NMC.

Since Mandarin NMCs call for an approach that recognizes the role of semantics and pragmatics in accounting for the processing and acquisition of these constructions, it would be useful to have a framework to describe the semantic and pragmatic relations between the modifiers and the head nouns.

3.2.4 Generative Lexicon (GL) Theory

Generative Lexicon (GL) Theory (Pustejovsky 1995) has become one of the most influential theories in semantics and qualia structure is a central framework in the GL theory.

In GL theory, Pustejovsky (1995) divides each lexical entry into the following four levels of representation:

1) Argument Structure: Specification of the number and the type of logical arguments, and how they are realized syntactically.

2) Event Structure: Definition of the event type of a lexical item or a phrase, including State, Process, and Transition. Events may have sub-eventual structure.

3) Qualia Structure: Modes of explanation, which are composed of Formal, Constitutive, Telic and Agentive roles.

4) Lexical Inheritance Structure: Identification of how a lexical structure is related to other structures in the type lattice, and its contribution to the global organization of a lexicon. (Pustejovsky 1995: p. 61)

The GL theory provides us with an explanatory model for capturing different levels of semantic representations for a lexical item. Across these semantic levels, the qualia structure reflects modification relations in the semantic composition within a compound best (Lenci et al. 2000). Similarly, Chinese NMCs are composed of a modifier and a head noun. As such, it can be deduced that qualia modification relations also exist between the modifiers and the heads of Chinese NMCs. As an initial attempt to delimit the scope of analysis from a semantic perspective, this study attempts to use qualia structure relations as a framework to analyze the semantic relations between the modifier and the head noun of NMCs in this study. Pragmatic analyses, while equally important, are not within the current focus of investigation.

3.2.4.1 Qualia Structure

Qualia roles express the basic features of semantics of nouns. According to the GL theory in Pustejovsky (1995), qualia structure specifies four essential aspects of a lexical item's meaning:

1) The Formal role can distinguish the object within a larger domain. Orientation, magnitude, shape, dimensionality, color, and position are its role values. For example: beautiful dancer, white paper.

2) The Constitutive role is the relation between an object and its constituents or parts. The role values include material, weight, parts and component elements. For example: glass door, heavy stone.

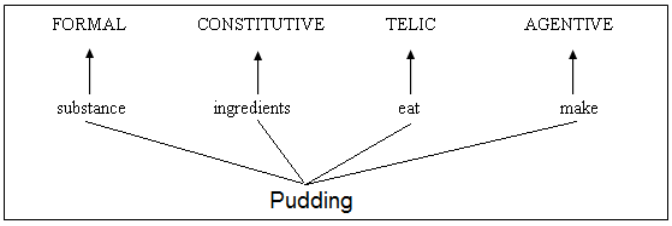
3) The Agentive role describes factors involved in the origin of an object, such as creator, artifact, natural kind, and causal chain. For example: bullet hole, lemon

juice.

4) The Telic role is about the purpose and function of an object. For example: hunting rifle, race car.

The four qualia roles do not lie on the same dimension, but they represent rather multiple dimensions of word meaning. Consider the noun *pudding*, as shown in (40):

(40)



These aspects of meaning are also crucial in the process of interpretation because of their linguistic effects. The following examples feature different aspects of the meaning of *pudding*:

(41) a. John refused the pudding (e.g., refused to eat - telic)

b. That's an easy pudding (e.g., easy to make - agentive)

c. There is pudding on the floor (e.g., substance - formal)

d. The pudding came out well (e.g., has been made well - agentive)

e. That was a nice bread pudding (e.g., made-of/ingredient - constitutive)

In GL framework, the qualia structure gives access to relational information that proves to be crucial for both linguistic analysis and for linguistic applications.

3.2.4.2 Application of GL Theory

Most applications of the GL theory have been in natural language processing. For instance, Lenci (2000) designed a classification model of SIMPLE based on Qualia structure of the GL theory. Yamada et al. (2007) proposed a method on the acquisition of telic role from the corpus data. Cimiano and Wenderoth (2007) proposed an approach to automatically learn qualia structures for nominals from the World Wide Web. Katrenko and Adriaans (2008) examined the influence of qualia structures in a concrete noun categorization task. Results indicated that categorization

was mostly influenced by the formal role, while other roles have not contributed discriminative features for this task. Results therefore suggested that the formal quale appears to be the primary semantic feature adults use in categorizing concrete nouns, followed by the constitutive quale, and then the agentive and telic quales.

The Generative Lexicon theory has also been used in languages other than English. For instance, Zavaglia and Greghi (2003) used the theory to analyze homonyms in Portuguese. In Chinese, for instance, Wang & Huang (2010) studied adjectival modification to nouns in Mandarin Chinese based on selective binding. They demonstrated that an adjective can select different types of head nouns as arguments, and an adjective may modify an individual or an event. The qualia structure of a noun helps us better understand an adjective's selectional preference and an adjective can modify only one facet of mult-facets of the qualia roles of a noun. Wang & Huang (2011a) investigated the possessive relation of "Possessor DE Possessee" construction based on the generative lexicon theory. In another study, Wang & Huang (2011b) examined morphological and syntactic structure, qualia modification, event representing feature, and information inheritance characteristics that were encoded in compound event nouns of Mandarin.

Despite the fact that GL theory has become one of the most influential theories in semantics, thus far, there appears to be no study using ideas from this theory to shed light on issues in child language acquisition. This study made an initial attempt in using qualia structure as a framework to characterize the semantic relations between the modifiers and the head nouns of NMCs in children's Mandarin.

3.2.4.3 Qualia Structure Classification in SIMPLE

The classification in Pustejovsky (1995) is a theoretical description of the qualia structures of a noun. The SIMPLE model, proposed by Lenci et al. (2000) based on Pustejovsky (1995), is a practical system of the theories proposed in Pustejovsky (1995).

The SIMPLE model is primarily based on three lexical frameworks (Lenci et al, 1998): The Geneiatlve Lexicon (cf. Pustejovsky 1995), WoldNet (cf. Miller and Fellbaum 1991), and EuroWordNet (cf. Vossen et al. 1998). One of the basic tasks during the SIMPLE lexicon encoding phase is the assignment of semantic type to the

word senses to be encoded (called the semantic units or SemU's). A set of schematic structures called 'templates' constituting the SIMPLE Ontology (consisting of approximately 140 semantic types in all) guide this encoding process.

The multiple dimensions of meaning are represented in SIMPLE by the use of qualia structure from the Generative Lexicon theory (Pustejovsky 1995). The SIMPLE project aims at adding a semantic layer to a subset of the existing morphological and syntactic layers. According to Pustejovsky (1995) and Lenci et al. (2000), qualia structure not only involves four different roles (i.e. formal, constitutive, telic and agentive), but there are also many subtypes within each qualia relation. The following paragraphs discuss these subtypes in greater details.

Formal qualia relations can have subtypes of Color (modifier denotes the characteristic of the color of the head); Shape (modifier denotes the shape kind characteristics of the head); Location (head is in or lives in the domain of the modifier); Magnitude (modifier denotes the size of the head); State (modifier describes the external state of the head); and Dimensionality (modifier denotes the dimension feature of the head).

Constitutive qualia relations can have subtypes of Parts (head is a part of the modifier); Component elements (modifier is a component element of the head); Quality (modifier is the property, quality of the head); Member (head is a member of the modifier); Possessive (modifier possesses the head), Quantity (modifier expresses the quantity of the head); Relation (modifier relates the head with a kind of typical relation, such as kinship, counterpart etc.); Taste (modifier expresses the taste of the head); Material (head is made of the modifier); and Weight (modifier denotes the weight of the head).

Agentive qualia relations may include subtypes of Creator (head is created by a certain human process or action); Experience (modifier is an event experienced by an individual); Source (modifier is the source or origin of the head); Causal Chain (modifier causes the occurrence of the head); Natural Kind (relation is about natural phenomenon); Derivation (head is derived from a certain process of alternation presented by the modifier); and Progress (modifier is an event which is ongoing while an individual has this property expressed by the head).

As for Telic qualia relations, the subtypes can be Function (modifier describes the function or effect of the head); Object of activity (head is the object of an activity expressed by the modifier); Ability (modifier describes the ability of the head); Habit (modifier describes the habit or custom of the head); Purpose (modifier is the purpose or aim of the event expressed by the head); and Result (modifier is the result expressed by the head).

As an initial attempt to study the acquisition of NMCs in the Mandarin of children from a semantic perspective, we first focus on characterizing the semantic relations between the modifier and the head noun of NMCs in young children's speech across age.

3.3 Methodology of the Current Study

This section provides a detailed description of the nature and source of the data, the procedures for data analysis, and the classification criteria for classifying different types of NMCs in the current study.

3.3.1 Source of Data

The data analyzed in this study came from the same corpus as that in Study 1 (i.e., corpus "Zhou2" deposited at the Child Language Data Exchange System (CHILDES) archive. Please see section 2.3.1 in Chapter Two for the introduction of CHILDES and the corpus "Zhou2".

3.3.2 Data Retrieval

In Study 1, the standard search tool KWAL in the program CLAN was used to retrieve 5026 utterances with 的 *de* from 276 files featuring 135 mother-child pairs. The output files were converted into Microsoft Excel format for further manual coding and disambiguation.

Among these 5026 utterances with 的 *de*, the following non-NMCs were excluded.

Cleft constructions 是…的 *shi*…*de* such as example (42):

(42) 小蛇　是　这样　　的
xiaoshe shi zheyang de
little snake is like this DE
'It is like this of the little snake.'

Utterances with 的 *de* serving as sentence final particle such as example (43):

(43) 这样　　拼　的
zheyang pin　de
like this　build DE
'It is like this to build (blocks).'

After excluding the irrelevant utterances with 的 *de*, there were 3549 NMCs altogether, including 850 NMCs produced by 135 children and 2699 NMCs attested in the mother-to-child speech in the same corpus. These NMCs include those that fall within the traditional domain of RCs (called RC-type NMCs here) and those that do not fall within the traditional domain of RCs (called non-RC NMCs here). The latter type does not have a grammatical relation between the head noun and the modifier and so there cannot be a gap co-referential with the head, they are "gapless". In addition, the modifiers in these NMCs include both clausal and non-clausal.

3.3.3 Data Analysis

In this study, qualia structure relations in Generative Lexicon (GL) Theory (Pustejovsky 1995) were used as a framework to analyze the semantic relations between the modifier and the head noun of the NMCs.

As introduced in section 3.2.8, qualia structure specifies four essential aspects of a lexical item's meaning (Pustejovsky (1995), see also Lenci et al. (2000) for further elaborations), i.e., formal role, constitutive role, agentive role and telic role. The 3549 NMCs attested in the corpus were classified into four types depending on the qualia relations between the modifiers and the head nouns. Table 3.2 shows some illustrative examples of each type of NMCs attested in the corpus.

1) Formal type NMCs. The modifiers in this type of NMCs usually specify the outside or external characteristics of the head nouns.

2) Constitutive type NMCs. The modifiers in this type of NMCs indicate the internal characteristics of the head nouns.

3) Agentive type NMCs. The modifiers in this type of NMCs explain how something comes into being and describe the origin of the head nouns.

4) Telic type NMCs. The modifiers in this type of NMCs describe the purpose and function of the head nouns.

Table 3.2: The Qualia Structures of NMCs

Qualia Structure	Meaning	English Examples	Examples from	
			Child	Adult
FORMAL	The modifiers in this type of NMCs usually specify the outside or external characteristics of the heads.	Brick tea; Granulated sugar; White paper.	a. 大大的苹果 (3;00)* dada de pingguo 'big apple' b. 橘黄的高楼 (3;00) juhuang de gaolou 'orange color building' c. 漂亮的颜色 (4;06) piaoliang de yanse 'beautiful color' d. 公园里的花 (3;00) gongyuan-li de hua 'the park's flowers' e. 弯弯的月亮 (5;00) wanwan de yueliang 'curved moon'	a.白色的纸 (3;00) baise de zhi 'white paper' b.漂亮的汽球 (3;06) piaoliang de qiqiu 'beautiful ballons' c.很小的黑点 (5;06) henxiao de heidian 'small black dots' d.小蘑菇的房子 (3;00) xiao mogu de fangzi 'mushroom-looking house' e.尖尖的房顶 (5;06) jianjian de fangding 'pointed roof'
CONSTITUTIVE	The Constitutive quale shows the relation between an object and its constituents, or proper parts. The modifiers in this type of NMCs usually indicate the internal characteristics of the heads.	Glass door; Chocolate cake;	a.长颈鹿的脖子 (5;00) changjinglu de bozi 'the giraffe's neck' b.玻璃的（杯子）(6;00) boli de (beizi) 'a glass cup' c.桌子的腿 (4;00) zhuozi de tui 'table's legs'	a. 她的梳子 (5;00) ta de shuzi 'Her comb' b. 很多的东西 (6;00) hen duo de dongxi 'A lot of things' c.汽车的轮子(4;00) qiche de lunzi 'the car's wheels'
AGENTIVE	The Agentive quale explains how something comes into being. The modifiers in NMCs always have the meaning of bringing out the head nouns.	Lemon juice; Bacterion infection.	a. 宝宝的声音 (3;06) baobao de shengyin 'baby's voice' b. 老师教我们的（画）(5;00) laoshi jiao women de (hua) 'the picture which our teacher taught us to draw' c. 我搭的球 (3;06) Wo da de qiu 'the ball which I built'	a. 你弄的火箭(3;06) ni nong de huojian 'the rocket you built' b. 安徒生的童话(4;06) Antusheng de tonghua 'fairy tales written by Andersen' c.妈妈想象的（样子）(4;00) Mama xiangxiang de (yangzi) 'the configuration that mummy thinks of (mummy and child were playing with stacking blocks)'
TELIC	In the NMCs with Telic quale, the modifiers have the meaning of describing the purpose of the heads.	Operation knife; Drinking water.	a. 画画的（笔）(3;06) huahua de (bi) 'pen for drawing' b.可以玩的（积木）(5;00) keyi wan de jimu 'blocks for playing'	a.球是拍的东西 (4;06) qiu shi pai de dongxi 'the thing (ball) for bouncing' b.投篮的地方 (4;00) toulan de difang 'place for playing basketball'

			c. 吃的东西 (6;00) chi de dongxi 'things for eating'	

* The number in parentheses indicates the age of the child in naturalistic child speech OR the age of the child to whom the adult was speaking to in adult child-directed speech.

According to Pustejovsky (1995) and Lenci (2000), there are many subtypes under each type of qualia relation. For example, formal qualia relations can have subtypes of Color, Shape, Location, Magnitude, State, and Dimensionality. Constitutive qualia relations can have subtypes of Parts, Component elements, Quality, Member, Possessive, Quantity, Relation, Taste, Material, and Weight. Agentive qualia relations may include subtypes of Creator, Experience, Source, Causal Chain, Natural Kind, Derivation, and Progress. For Telic qualia relations, the subtypes can be Function, Object of activity, Ability, Habit, Purpose, Result and so on. All the NMCs are further classified into different subtypes based on the classification above. Tables 3.3-3.6, which follow, provide more detailed descriptions and illustrative examples of the main subtypes of each qualia relation attested in the corpus. If there was no actual example attested in the corpus to illustrate a subtype, some examples will be made up and listed in the columns 'Other'.

Table 3.3 Subtypes of Formal Qualia relation in NMCs

Qualia	Subtype	Meaning	English Examples	Examples	
				Child	Adult
F	Color	The modifier denotes the characteristic of the color of the head	White paper	a.红颜色的（笔）(5;00) hong yanse de (bi) 'red (pencils)' b.什么颜色的（笔）(4;06) shenme yanse de (bi) '(a pen) of what color'	a.五颜六色的花 (4;06) wuyanliuse de hua 'colorful flowers' b.什么颜色的盒子 (3;00) shenme yanse de hezi 'a box of what color'
	Shape	The modifier denotes the shape characteristics of the head	Brick tea; Granulated sugar	a.三角形的（东西）(5;06) sanjiaoxing de (dongxi) 'triangle things' b.一样的东西 (4;00) yiyang de dongxi 'same thing' c.尖尖的嘴 (5;06) jianjian de zui 'a pointed mouth'	a.三角形的耳朵 (4;00) sanjiaoxing de erduo 'triangle ears' b.方方的积木 (3;06) fangfang de jimu 'square blocks'
	Location	The head is in or lives in the domain of the modifier	Pudding on the floor	a.公园里的花(3;00) gongyuan li de hua 'flowers in the park' b.手里拿的东西(5;00) shou li na de dongxi 'things in your hands' c.天上的星星(4;06) tianshang de xingxing 'stars in the sky'	a.这上面的字母(3;06) zhe shangmian de zimu 'the letter above (on this paper)' b.下面的盒子(6;00) xiamian de hezi 'the box below' c.南极的动物(6;00) nanji de dongwu 'animals in Antarctica'
	Magnitude	The modifier denotes the size of the head	Big spider	a.大一点的纸 (3;00) da yidian de zhi 'a bigger piece of paper' b.好长的尾巴 (4;00) hao chang de weiba 'long tails' c.细细长长的腿 (3;06) xixi changchang de tui 'small and long legs'	a.大大的圆 (3;06) dada de yuan 'a big circle' b.矮一点的房子 (4;00) ai yidian de fangzi 'a shorter house' c.高高的鼻子 (5;00) gaogao de bizi 'a high nose'
	State	The modifier describes the external state of the head	Beautiful flower	a.乱七八糟的声音 (4;00) luanqibazao de shengyin 'messy sounds' b.原来的（样子）(5;06) yuanlai de Yangzi 'previous looks' c.受伤的小东西 (6;00) shoushang de xiao dongxi 'a little (mouse) who was injured'	a.漂亮的画 (6;00) piaoliang de hua 'a beautiful picture' b.不一样的位置(5;00) bu yiyang de weizhi 'different positions' c.直直的（树干）(5;00) zhizhi de shugan 'straight (tree trunk)'
	Dimensionality	The modifier denotes the dimension feature of the head	Solid cube	a.双层的（楼）(4;00) shuangceng de (lou) '2-storey building' b.立体的（东西）(6;00)	a.一块一块的（积木）(5;00) yikuai yikuai de (jimu) 'pieces of building blocks' b.平面的（东西）(6;00)

				liti de (dongxi) ‘3D things’	pingmian de (dongxi) ‘flat-surface things’ c.空心的圆 (3;00) kong xin de yuan ‘hollow circle’

Table 3.4 Subtypes of Constitutive Qualia Relation in NMCs

Qualia	Subtype	Meaning	English Examples	Examples		
				Child	Adult	Other
C	Parts	The head is a part of the modifier	Airplane wing	a.长颈鹿的角 (5;00) changjinglu de jiao 'giraffe's horns' b.小白兔的眼睛 (3;06) xiaobaitu de yanjing 'little rabbit's eyes' c.桌子的腿 (4;00) zhuozi de tui 'table's legs'	a.乌龟的脖子 (3;06) wugui de bozi 'turtle's neck' b.太阳公公的笑脸(4;06) taiyang gonggong de xiaolian 'the sun's smiling face' c.皮大衣的毛领子(5;06) pidayi de mao lingzi 'the collar of the fur coat'	
	Component elements	The modifier is a component element of the head	Chocolate cake	a.小老鼠的故事 (5;00) xiao laoshu de gushi 'a story about a little mouse' b.汽车的书 (3;00) qiche de shu 'a book about cars' c.有果子的（树）(5;00) you guozi de shu 'a tree with fruits on it'	a.蒲公英的歌 (6;00) pugongying de ge 'a song about the dandelion' b.摆满果子的大船(5;00) bai man guozi de dachuan 'a boat full with fruits' c.蚂蚁的故事 (3;00) mayi de gushi 'a story about ants'	
	Quality	The modifier is the property, quality of the head	Real spider	a.坏的（香蕉）(4;00) huai de (xiangjiao) 'bad bananas' b.新新的（玩具）(3;00) xinxin de wanju 'new toys' c.真的鸟 (6;00) zhen de niao 'real birds'	a.简单的（东西）(3;06) jiandan de (dongxi) 'simple (things)' b.假的（东西）(6;00) jia de (dongxi) 'fake (things)' c.奇怪的种子 (3;06) qiguai de zhongzi 'strange seeds'	
	Possessive	The modifier possesses the head	The girl's car	a.姐姐的裙子 (3;06) jiejie de qunzi 'sister's skirt' b.老师的（东西）(4;06) laoshi de (dongxi) 'teacher's (things)' c.谁的盒子 (3;06) shei de hezi 'whose box'	a.他们的房子 (3;00) tamen de fangzi 'their house' b.你的名字 (3;06) ni de mingzi 'your name' c.谁的小皮球 (4;06) shei de xiao piqiu 'whose little ball'	
	Quantity	The modifier expressed the quantity of the head	A bottle of water	很多的蜻蜓(5;06) henduo de qingting 'many dragonflies'	a.很多的（东西）(6;00) henduo de dongxi 'many things' b.这么多的轮子 (4;06) zheme duo de lunzi 'so many wheels' c.所有的老鼠 (3;06) suoyou de laoshu	

					‘all the mouses’	
	Relation	The modifier relates the head with a kind of typical relation, such as kinship, counterpart etc.	The girl’s sister	a.他的爸爸 (5;00) ta de baba ‘his father’ b.老鼠的小孩子 (4;06) laoshu de xiao haizi ‘mouse’s children’	a.卡布达的新朋友(3;00) kabuda de xin pengyou ‘kabuda’s new friends’ b.你的同学 (4;00) ni de tongxue ‘your classmates’ c.它们的邻居 (3;00) tamen de linju ‘their neighbors’ d.书的英语 (3;00) shu de yingyu ‘the English counterpart of the word *shu*’	
	Taste	The modifier expresses the taste of the head	Spicy food	好吃的（东西）(5;06) haochi de (dongxi) ‘delicious (food)’	a.好吃的东西 (3;06) haochi de dongxi ‘delicious food’ b.甜的（东西）(3;00) tian de (dongxi) ‘sweet (things)’ c.美味的果子 (3;06) meiwei de guozi ‘delicious fruits’	
	Material	The head is made of the modifier	Glass door	玻璃的（杯子）(6;00) boli de (beizi) ‘glass (cup)’	none	木头的椅子 mutou de yizi ‘wood chairs’

Table 3.5 Subtypes of Agentive Qualia Relation in NMCs

Qualia	Subtype	Meaning	English Examples	Examples		
				Child	Adult	Other
A	Creator	The head is created by a certain human process or action	Written book	a.我搭的球 (3;06) wo da de qiu 'the ball I built' b.我做的楼梯 (6;00) wo zuo de louti 'the stairs I made'	a.安徒生的童话 (4;06) Antusheng de tonghua 'fairy tales written by Andersen' b.一起画的花 (3;00) yiqi hua de hua 'flowers which were drawn together'	
	Experience	The modifier is an event experienced by an individual	Felt fear	a.我记住的东西 (5;06) wo jizhu de dongxi 'the thing I remember' b. 最喜欢的玩具 (6;00) zui xihuan de wanju 'the toy I like best'	a.最喜欢的颜色 (3;06) zui xihuan de yanse 'most favorite color' b.妈妈想象的（样子）(4;00) mama xiangxiang de (yangzi) 'the configuration that mummy thinks of (mummy and child were playing with stacking blocks)'	
	Source	The modifier is the source or origin of the head	Lemon juice	a.宝宝的声音 (3;06) baobao de shengyin 'baby's voice' b.买回家的笔 (4;06) mai huijia de bi 'pens that were bought for home' c.我说的（故事）(5;00) wo shuo de (gushi) 'the story I told'	a.大风破坏的房屋 (4;00) dafeng pohuai de fangwu 'the house destroyed by the strong wind' b.拿出来的（颜色）(3;00) na chulai de (yanse) 'the color you took out' c.妈妈教你的（事）(4;00) mama jiao ni de (shi) 'the thing mummy taught you'	
	Causal Chain	The modifier caused the occurrence of the head	Bacterion infection	none	不听话的结果 (6;00) butinghua de jieguo 'the result of being naughty'	感染的病毒 ganran de bingdu 'virus infected'
	Natural Kind	The relation is about natural phenomenon	Thunder sound	none	a.太阳的光芒 (4;00) taiyang de guangmang 'the light of the sun' b.空气的阻力 (6;00) kongqi de zuli 'resistance of the air'	打雷的声音 dalei de shengyin 'the sound of the thunder'
	Derivation	The head is derived from a certain process	Petrol oil	none	变形后的铁甲小宝 (3;00) bianxing hou de	融化的雪 ronghua de xue

		of alternation presented by the modifier			tiejiaxiaobao 'a toy robot after being transformed	'melted snow'

Table 3.6 Subtypes of Telic Qualia Relation in NMCs

Qualia	Subtype	Meaning	English Examples	Examples		
				Child	Adult	Other
T	Function	The modifier describes the function or effect of the head	Bread knife	a.刷牙的（东西）(3;00) shuaya de (dongxi) 'the thing for brushing teeth' b.盖的（被子）(5;00) gai de (beizi) 'the quilt for covering' c.投篮的地方 (5;06) toulan de difang 'a place for playing basketball'	a.画画的笔 (3;06) huahua de bi 'a pen for drawing' b.走的小桥 (4;06) zou de xiaoqiao 'a bridge for walking' c.爬上去的台阶(3;00) pa shangqu de taijie 'stairs for you to climbing up'	
	Object of activity	The head is the object of an activity expressed by the modifier	Drinking water	a.喝的（东西）(6;00) he de (dongxi) 'things for drinking' b.吃的东西 (4;00) chi de dongxi 'things for eating'	a.看过的故事书 (3;06) kan guo de gushi shu 'the story book you read before' b.你玩的（东西）(3;00) ni wan de (dongxi) 'the thing for you to play' c.戴的帽子 (4;06) dai de maozi 'a hat for wearing'	
	Ability	The modifier describes the ability of the head	Painting painter	a.会发光的眼睛 (4;06) hui faguang de yanjing 'eyes that can shine' b.会转的（玩具）(5;06) hui zhuan de wanju 'a toy that can revolve' c.可以飞的天鹅 (4;06) keyi fei de tian'e 'a swan that can fly'	a.会动的（玩具）(3;06) hui dong de wanju 'a toy that can move' b.可以走路的（玩具）(6;00) keyi zoulu de wanju 'a toy that can walk'	
	Habit	The modifier describes the habit or custom of the head	Smoking smoker	吃大恐龙的（东西）(3;06) chi da konglong de (dongxi) 'the thing that eats big dinosaurs'	none	喝酒的醉鬼 hejiu de zuigui 'a drunkard who drinks'
	Purpose	The modifier is the purpose or aim of the event expressed by the head	Earning job	你的电话 (6;00) ni de dianhua 'a call that is looking for you'	none	赚钱的工作 zhuanqian de gongzuo 'the job that can earn money'
	Result	The modifier is the result of what is expressed by the head	Failure reason	none	要哭的（事情）(4;00) yao ku de (shiqing) 'the incident that makes you cry'	失败的原因 shibai de yuanyin 'the reason of failure'

3.4 Results

3.4.1 Qualia Structures of NMCs in Child Naturalistic Speech

There were 850 NMCs produced by 135 children. These NMCs were grouped into four types according to the Qualia relations between the modifiers and the head nouns. Table 3.7 lists the distribution of different types of Qualia relations in NMCs at different ages.

Table 3.7: Distribution of NMCs Expressing the Four Major Qualia Roles in Children's Naturalistic Speech across Age

	Formal		Constitutive		Agentive		Telic	
Age	Token	%	Token	%	Token	%	Token	%
3;00	75	67.60	20	18.00	14	12.60	2	1.80
3;06	77	71.30	22	20.40	6	5.60	3	2.80
4;00	73	54.90	40	30.10	7	5.30	13	9.80
4;06	62	59.00	29	27.60	5	4.80	9	8.60
5;00	74	52.90	48	34.30	11	7.90	7	5.00
5;06	49	42.60	38	33.00	21	18.30	7	6.10
6;00	65	47.10	46	33.30	17	12.30	10	7.20

Results indicate that across all the seven age groups, NMCs expressing the formal quale were most frequently attested, accounting for more than two-thirds of the NMCs produced at ages 3;00 and 3;06 and close to half of the NMCs produced for the remaining five age groups.

NMCs expressing constitutive quale were consistently ranked second for all age groups, accounting for at least a quarter of the NMCs produced from age 4;00 to 6;00 age groups.

NMCs expressing the telic or agentive quale were relatively less frequently attested.

Upon further examination of the data for each individual child, the developmental pattern appears to be consistent with the findings reported above based on frequency of use of NMCs. Table 3.8 lists the number and percentage of children in each age group producing at least one instance of a particular qualia type in their language samples.

Table 3.8: Number and Percentage of Children in Each Age Group Producing At Least One Instance of a Particular Qualia Type in Their Language Samples

Age group (number of children featured)		Formal	Constitutive	Agentive	Telic
3;00(20)	No. of children	19	10	8	2
	%	95.00	50.00	40.00	10.00
3;06(21)	No. of children	19	10	3	2
	%	90.48	47.62	14.29	9.52
4;00(16)	No. of children	15	13	4	8
	%	93.75	81.25	25.00	50.00
4;06 (19)	No. of children	18	10	4	8
	%	94.74	52.63	21.05	42.11
5;00 (22)	No. of children	18	16	7	5
	%	81.82	72.73	31.82	22.73
5;06(16)	No. of children	10	11	10	6
	%	62.50	68.75	62.50	37.50
6;00(21)	No. of children	21	15	7	5
	%	100.00	71.43	33.33	23.81
Total no. of children featured in the corpus: 135	Total no. of children producing a particular type of NMCs	120	85	43	36
	%	88.89	62.96	31.85	26.67

Results indicated that by age 3;00 and thereafter (except for the 5;6 age group), more than 80% of the children in their respective age group had at least one NMC expressing the formal quale attested in their speech sample.

By age 3;00 and 3;06, around 50% of the children in their respective age group had at least one NMC expressing the constitutive quale attested in their speech sample. By age 4;00 and consistently thereafter, more than 50% of the children in their respective age group had at least one NMC expressing the constitutive quale attested in their speech sample.

As for agentive quale, 40% of the children (8 out of 20 children) in the 3;00 age group had at least one NMC expressing this quale attested in their speech sample. Thereafter, for the older age groups, there was not a consistent pattern with the percentage of children ranging from 14% to 63% in their respective age group producing at least one NMC expressing this quale in their language samples.

As for telic quale, there were only around 10% of the children in the 3;00 and 3;06 age groups producing at least one NMC expressing this quale in their speech

sample. 4;00 was the youngest age group in which a sizable proportion of children (50%; 8 out of 16 children) were producing at least one NMC expressing this quale in their language samples. Thereafter, for the older age groups, there was not a consistent pattern with the percentage of children ranging from 23% to 42% in their respective age group producing at least one NMC expressing this quale in their language samples.

Taken together the above facts, these findings suggest that NMCs expressing formal quale are acquired earliest; followed by constitutive; and, then, agentive and telic.

3.4.2 Use of Subtypes of Qualia Relations in Child Naturalistic Speech

This section discusses the age at which each subtype of the four qualia relations of NMCs emerges.

Table 3.9 presents the subtypes of formal NMCs attested in the corpus. In terms of frequency of use, color ranked first, followed by magnitude and shape, and then location, state, and dimensionality, with color being most frequent. In terms of the age group at which a clear instance of a particular subtype was first attested in the corpus data, the findings indicate that by age 3, Mandarin-speaking children are already using a good range of subtypes of formal NMCs in their spontaneous speech.

Table 3.9: Subtypes of Formal NMCs Attested in Child Naturalistic Speech

Formal	Token	Examples	Age group at which a clear instance was first attested in the corpus
Color	45	绿颜色的 Lv yanse de Green DE 'green one'	3;00
Magnitude	17	大大的苹果 dada de pingguo Big DE apple 'big apple'	3;00
Shape	17	方块的 fangkuai de square DE 'square one'	3;00
Location	5	公园里的花 gongyuan li de hua Park in DE flower 'the flower in the park'	3;00
State	3	转过去的 zhuan guoqu de turn away DE 'The one that is turning away'	3;00

Dimensionality	1	瘦的 shou de Slim DE 'The one who is slim'	3;00

Table 3.10 presents the subtypes of constitutive NMCs attested in the corpus. In terms of frequency of use, parts and possessive subtypes were most frequently attested, with the other subtypes also attested alongside these two dominant subtypes though used rather infrequently. In terms of the age group at which a clear instance of a particular subtype was first attested in the corpus data, the findings indicate that by age 3;6, Mandarin-speaking children are already using a good range of subtypes of constitutive NMCs in their spontaneous speech.

Table 3.10: Subtypes of Constitutive NMCs Attested in Child Naturalistic Speech

Constitutive	Token	Examples	Age group at which a clear instance was first attested in the corpus
Parts	11	它的眼睛 Ta de yanjing It DE eyes 'It's eyes'	3;00
Possessive	10	你的子弹 Ni de zidan You DE bullet 'your bullet'	3;00
Quality	3	新新的 xinxin de New DE 'new things'	3;00
Taste	1	好吃的 haochi de Delicious DE 'delicious things'	3;00
Component elements	2	汽车的书 qiche de shu Car DE book 'the book about cars'	3;00
Relation	1	它们的宝宝 tamen de baobao They DE baby 'their baby'	3;06
Quantity	1	很多的蜻蜓 henduo de qingting Many DE dragon-fly 'many dragon-flys'	5;06
Material	1	玻璃的 boli de Glass DE 'The one that is made of glass'	6;00

Table 3.11 presents the subtypes of agentive NMCs attested in the corpus. Agentive NMCs were not frequently attested. In terms of frequency of use, the 'creator' subtype was most frequently attested and as early as age 3 in Mandarin-speaking children's spontaneous speech.

Table 3.11: Subtypes of Agentive NMCs Attested in Child Naturalistic Speech

Agentive	Token	Examples	Age group at which a clear instance was first attested in the corpus
Creator	9	我 搭好 的 Wo dahao de I build DE 'The one that I built'	3;00
Source	2	宝宝 的 声音 baobao de shengyin baby DE voice 'baby's voice'	3;06
Experience	1	我记住的东西 Wo jizhu de dongxi I remember DE thing 'The thing that I remember'	5;06

Similarly, Telic NMCs were rarely attested in the current corpus, despite the fact that the corpus features as many as 135 Mandarin-speaking children aged 3 to 6. Table 3.12 presents the subtypes of Telic NMCs attested in the corpus.

Table 3.12: Subtypes of Telic NMCs Attested in Child Naturalistic Speech

Telic	Token	Examples	Age group at which a clear instance was first attested in the corpus
Function	2	刷牙的 Shuaya de Brush teeth DE 'The thing for brushing teeth'	3;00
Habit	1	吃大恐龙的 chi da konglong de Eat big dinosaur DE 'The thing that eats big dinosaurs'	3;06
Ability	1	能打斗的 neng da dou de Can fight DE 'The one that can fight'	4;00
Object of activity	1	叫我看的蓝颜色 jiao wo kan de lanyanse Ask me look De blue 'the blue one that you asked me to look at'	4;06

3.4.3 Non-RC Type and RC Type NMCs Expressing Different Qualia Relations

Table 3.13 shows the distribution of non-RC and RC-type NMCs expressing the four major qualia roles in child Mandarin naturalistic speech across age. Three major findings are highlighted as follows. First, in general, RC-type NMCs constitute only 16.24 % (138 out of 850 NMCs) of all the NMCs attested in children's spontaneous speech. That is, non-RC type NMCs are more prevalent in general. Second, the majority of NMCs expressing the formal and the constitutive quales are non-RC type NMCs; while the majority of NMCs expressing the agentive and telic quales are RC-type NMCs. Third, RC-type NMCs "emerge" either alongside the other non-RC type NMCs for the formal and agentive quales, or "emerge" later than the other non-RC type NMCs for the constitutive quale. As for the telic quale, interestingly, non-RC type NMCs were rarely attested in the current dataset. One may wonder whether RC-type NMCs "emerge" earlier than the other non-RC type NMCs for this quale. However, since the overall token of NMCs expressing the telic quale is low, it is difficult to draw a cogent statement for the telic quale.

Table 3.13: The Distribution of Non-RC and RC-type NMCs Expressing the Four Major Qualia Roles in Children's Naturalistic Speech across Age

Age	Qualia	Formal		Constitutive		Agentive		Telic	
	RC Type	Token	%	Token	%	Token	%	Token	%
3;00	Non-RC	72	74.20	20	20.60	5	5.20	0	0.00
	RC	3	21.40	0	0.00	9	64.30	2	14.30
3;06	Non-RC	76	76.80	22	22.20	1	1.00	0	0.00
	RC	1	11.10	0	0.00	5	55.60	3	33.30
4;00	Non-RC	69	62.20	38	34.20	3	2.70	1	0.90
	RC	4	18.20	2	9.10	4	18.20	12	54.50
4;06	Non-RC	57	64.00	29	32.60	3	3.40	0	0.00
	RC	5	31.20	0	0.00	2	12.50	9	56.20
5;00	Non-RC	67	57.30	46	39.30	4	3.40	0	0.00
	RC	7	30.40	2	8.70	7	30.40	7	30.40
5;06	Non-RC	49	57.60	31	36.50	5	5.90	0	0.00
	RC	0	0.00	7	23.30	16	53.30	7	23.30
6;00	Non-RC	63	55.30	42	36.80	7	6.10	2	1.80
	RC	2	8.30	4	16.70	10	41.70	8	33.30

3.4.4 Correspondence between Child Output and Adult Input

A parallel analysis was also conducted for the adult child-directed speech data to examine the correspondence between child output and adult input. Table 3.14 shows

the results on child output and adult input within the same table. Figure 3.1 and Figure 3.2 show the distribution of NMCs expressing the four major qualia roles attested in child naturalistic speech and adult child-directed speech respectively and separately.

Table 3.14: Distribution of NMCs Expressing the Four Major Qualia Roles in Child Output and Adult Input (mother-to-child's naturalistic speech) Across Age

Speaker		Formal		Constitutive		Agentive		Telic	
	Age	Token	N %	Token	N %	Token	N %	Token	N %
Child	3;00	75	67.60	20	18.00	14	12.60	2	1.80
	3;06	77	71.30	22	20.40	6	5.60	3	2.80
	4;00	73	54.90	40	30.10	7	5.30	13	9.80
	4;06	62	59.00	29	27.60	5	4.80	9	8.60
	5;00	74	52.90	48	34.30	11	7.90	7	5.00
	5;06	49	42.60	38	33.00	21	18.30	7	6.10
	6;00	65	47.10	46	33.30	17	12.30	10	7.20
Adult	3;00	263	52.80	149	29.90	44	8.80	42	8.40
	3;06	238	51.50	145	31.40	61	13.20	18	3.90
	4;00	207	50.90	128	31.40	45	11.10	27	6.60
	4;06	208	53.20	96	24.60	65	16.60	22	5.60
	5;00	177	49.40	101	28.20	60	16.80	20	5.60
	5;06	95	43.60	72	33.00	36	16.50	15	6.90
	6;00	161	44.10	115	31.50	60	16.40	29	7.90

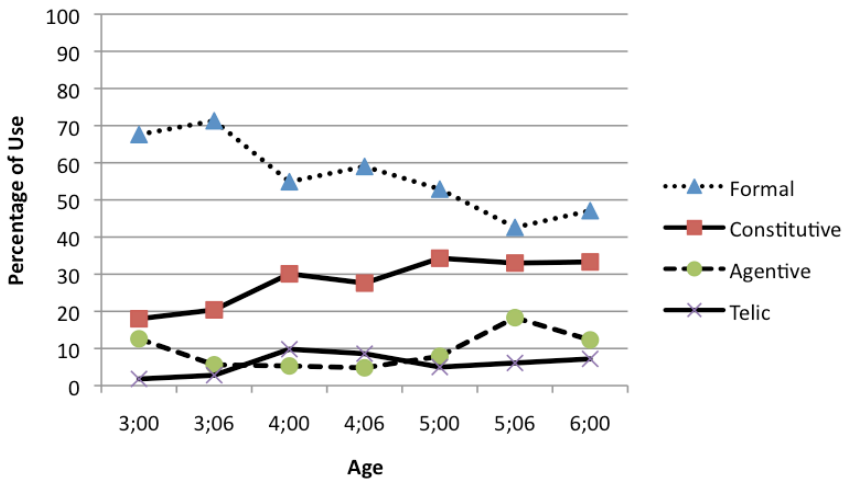


Figure 3.1 Use of NMCs Expressing the Four Major Qualia Roles in Child Naturalistic Speech

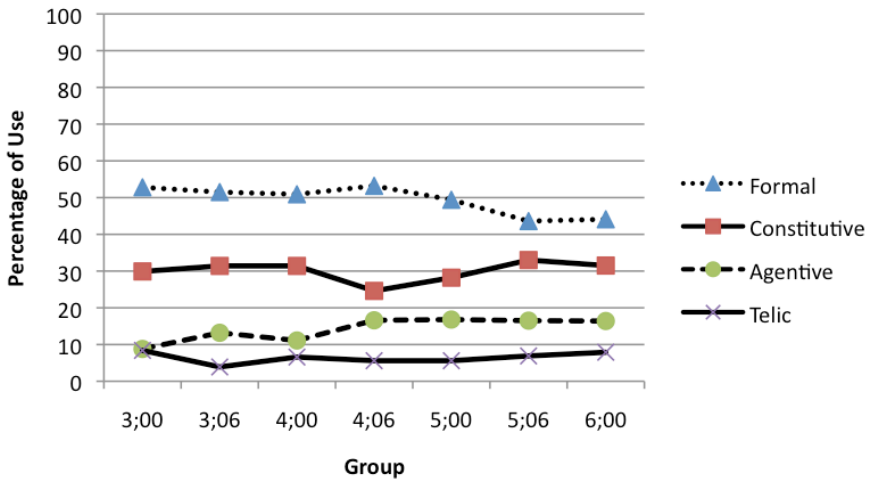


Figure 3.2 Use of NMCs Expressing the Four Major Qualia Roles in Adult Child-Directed Speech

The findings indicate parallels between the developmental findings and the adult input properties: NMCs expressing the formal quale were used most frequently, followed by the constitutive quale, and then the agentive and telic qualia.

3.5 Discussion

How do we account for the developmental patterns observed? This section considers (i) semantic nature and complexity of the four qualia relations; (ii) adult input properties; and (iii) structural complexity.

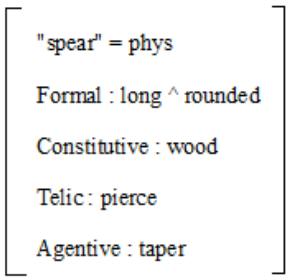
3.5.1 Semantic Nature and Complexity of the Four Qualia Relations

In Generative Lexicon Theory, Pustejovsky (1995: p. 76) stated that (a) every word category has a "qualia structure" (i.e. a group of the four qualia), but (b) a specific lexical item does not need to realise every quale. GL has been developed around three basic levels of types of individuals:

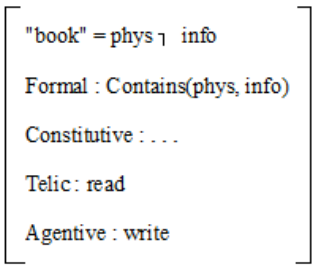
(44) Natural type: natural concepts, which only refer to formal and constitutive qualia, such as:

$$\begin{bmatrix} \text{"stick"} = \text{phys} \\ \text{Formal} : \text{long} \wedge \text{rounded} \\ \text{Constitutive} : \text{wood} \end{bmatrix}$$

(45) Artificial type: concepts created from natural type by the addition of telic or agentive quale, such as:



(46) Complex type: concepts that integrate relation between two types, such as:



The semantic representation is used in the compositional process to provide an interpretation of an expression.

Artifacts differ from natural kinds by an assignment of a telic or agentive quale; a piece of rock that looks like a neolithic arrowhead is just a natural kind, unless it has been used or made to be used as an arrowhead. It seems that a (potential) purpose aspect of a word meaning could thus be formulated in terms of more basic qualia, i.e. formal and constitutive. Pustejovsky and Jezek (2008) proposed that telic quale be connected with agentive quale to formalise the intuition that artifacts are made for a purpose. They also proposed that telic and agentive qualia are based on formal and constitutive qualia, and that the agentive and telic structures are derivative (hence semantically more complex).

Recall the child Mandarin findings in this study: NMCs expressing the formal quale are acquired earliest and used most frequently, followed by constitutive quale, and then agentive and telic qualia. The current developmental findings, therefore, are consistent with the semantic nature and complexity of the four qualia relations: formal and constitutive aspects of an object (called natural type concepts in Pustejovsky 2001, 2006) are more basic attributes, while telic and agentive (called artificial type

concepts in Pustejovsky 2001, 2006) are derived and often eventive (hence conceptually more complex).

3.5.2 Adult Input Properties

The developmental findings appear to be also consistent with the properties of their adult input. Recall that this study also conducted a parallel analysis of the 3053 NMCs attested in the mother-to-child speech in the Zhou2 corpus (refer back to Section 3.4.4). The adult input findings indicate that NMCs expressing the formal quale are also most frequently encountered in the adult input; followed by the constitutive quale, and then the agentive and telic quales. Children's usage patterns and developmental trajectory show a correspondence with the distributional frequency of their input. The findings are therefore consistent with the usage-based learning account in that distributional frequency of the input is one important factor influencing the acquisition trajectory (e.g. constructions that are more frequently encountered in the learner's experience will be more readily activated and thus easier to acquire).

3.5.3 Structural Complexity

The idea to consider here is that since the telic and agentive quales are derivative and always involve some event (which is in turn expressed by a full clause), telic and agentive NMCs are structurally more complex than the formal and constitutive ones and, therefore, acquired later. However, in Mandarin, telic and agentive NMCs can also be non-clausal (hence not necessarily always structurally more complex; e.g., *Baby's noise* "The noise made by the baby") and examples of these are also attested in the children's speech at an early age, although few. In addition, some NMCs expressing the formal quale with a clausal (hence structurally more complex) modifier are also noticed in the children's speech at an early age, although not frequently attested in the current corpus.

On the other hand, to clarify, it is not being claimed that structural complexity has no or only an insignificant role to play here. To fully consider and evaluate the role of structural complexity, experimental tasks, such as elicited production and imitation tasks, need to be studied in future research. Experiments that systematically elicit the four types of NMCs (formal, constitutive, agentive and telic) with varying

degrees of structural complexity (involving both clausal and non-clausal modifiers) need to be conducted.

3.6 Concluding Remarks

Traditionally, RCs have often been studied from a structural perspective and with little emphasis on the relationship between RCs and other types of NMCs in the language. More recently, however, linguists such as Comrie (1996, 1998, 2002) and Matsumoto (1997, 2007) have proposed that, in certain Asian languages, RCs should be analyzed as a subset of NMCs based on semantic-pragmatic relations between the head noun and its modifier.

Mandarin is an attributive clause language in Comrie's typology. As an initial attempt to study the acquisition of NMCs in children's Mandarin from a semantic perspective, this study focused on characterizing the semantic relations between the modifier and the head noun using the generative lexicon framework (Pustejovsky 1995).

This attempt is probably the first of using the generative lexicon framework in the field of child language acquisition. The new data and the observed developmental patterns based on the naturalistic speech of 135 Mandarin-speaking child-mother pairs may serve as a basis or reference for inspiring more experimental work and more wide-ranging cross-linguistic work examining the acquisition of NMCs from a semantic approach. Such cross-linguistic findings may reveal some robust descriptive generalizations about the acquisition of NMCs from a semantic perspective.

Chapter Four

Use of Headed versus Headless NMCs: Child Naturalistic Speech and Adult Child-directed Speech

4.1 Introduction

Study 2 characterizes the semantic relations between the modifier and the head noun of the NMCs attested in Mandarin child naturalistic speech and adult child-directed speech. Another typological feature of Chinese NMCs, targeted in study 3, is that the head noun of NMCs can be explicitly expressed (headed) or unexpressed (headless) in naturalistic discourse under certain licensing conditions.

In fact, during the process of data analyses for study 2, there appears to be an interesting phenomenon related to the headedness of NMCs and its possible relationship with certain semantic subtypes of NMCs. The observation was that when children produced NMCs expressing the formal quale, the head nouns were usually unexpressed (headless NMCs; see example 1a); but when children produced NMCs expressing the constitutive quale, the head nouns were often filled (referred here as headed NMCs; see example 1b).

(1) a. 红色 的 （积木） (formal, headless)
hongse de (jimu)
red DE (building blocks)
'red ones'

b. 兔子 的 脚 (constitutive, headed)
tuzi de jiao
rabbit DE foot
'the rabbit's foot'

Study 3, therefore, attempts to examine in greater details and depth the use of headed versus headless NMCs in both child naturalistic speech and adult input in Mandarin. The analyses will again be based on the same dataset of the 850 NMCs (including those traditionally defined as RCs) produced by 135 children aged 3 to 6 from the "Zhou2" corpus in CHILDES, and the 2699 NMCs (including RCs) attested in the mother-to-child speech in the same corpus.

Section 4.2 reviews the relevant acquisition studies on the topic of headness of RCs and Chinese *de* constructions. Section 4.3 describes the methodology of current study. Section 4.4 reports the results. Section 4.5 discusses the major findings and Section 4.6 presents the concluding remarks.

4.2 Literature Review

With regard to the topic of "headedness" in acquisition, previous studies have used different approaches and perspectives to analyze RCs or Mandarin *de* constructions, for instance, the structural approach, syntactic-semantic mapping, and pragmatic perspectives.

4.2.1 Structural Analysis on the Acquisition of Free Relatives

In studies on the acquisition of RCs in many languages, evidence has suggested that free relatives (the closest English counterpart to Chinese headless noun modifying constructions do not have an explicit antecedent and are referred to as headless RCs, see example 2a) are available at least as early as, or earlier than, headed structures (see example (2b)). This section introduces several structural analyses on the acquisition of free relatives in English, French and Korean.

(2) a. Look at what I drew.
b. Look at the picture that I drew.

Hamburger (1980) reported an early "proto-relative" form, which in some respects resembles a free relative, in the speech of a child (24-28 months) acquiring English. This study found that free relatives are acquired in the early stage of children's learning of RCs. For example, Hamburger cited examples from a child in (3), which is a determiner introducing a verb phrase.

(3) a. My did it. (refers to artwork the child had done)
b. There's a wash hands. (refers to sink; no action)
c. There's another wash hands.

Hamburger argued that the phrases *my did it* and *a wash hands* are clearly noun phrases.

Hamburger also addressed changes in this child's grammar. The structure in (3) loses its object in some child utterances, as shown in (4).

(4) a. Look at my did.

b. Look at my doing.

At the same time, structures like (5) retain their objects. This suggests that children know that *my* is a possessive pronoun, which needs an object to be a noun phrase.

(5) Find my brush teeth.

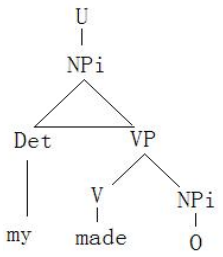
Hamburger suggested that if '*my did it'* in (3) is a noun phrase, the structures in (3a)-(3c) may be "proto-relatives" - early relative clause forms. He provided evidence that these "proto-relatives" lead directly to an adult-like free relative. He provided the example in (6), noting that it did not appear again for two months, during which time the child produced the structures in (3a)-(3c). But two months after (6) appeared, the conversation in (7) occurred.

(6) Look-a(t) my made

(7) Child: Look-a(t) my made ... Henny.
Adult: Huh?
Child: Look-a(t) wha(t)-I made.

Hamburger suggested that the child may have heard an adult utterance like "Look at what I made", but may have been "incapable at that time of incorporating into her grammar all of the adult rules involved in it" (Hamburger 1980: 411). Hamburger suggested that the child analyzes the utterance in (8):

(8)



(Hamburger, 1980:(41))

It was proposed in Hamburger (1980) that the child managed to match the adult verb phrase to that of her own phrase marker, but without adopting all the relevant adult rules. He suggested that free relatives are acquired in the early stage of children's learning of RCs.

Flynn and Lust (1981) investigated the acquisition of lexically headed RCs and headless relatives in English and found that headless relatives are acquired earlier than headed RCs. Their sentences include RCs of three different types: lexically headed with a semantically determinate head (see example 9a); lexically headed with a semantically non-determinate head (see example 9b); and non-lexically headed (free relative; see example 9c).

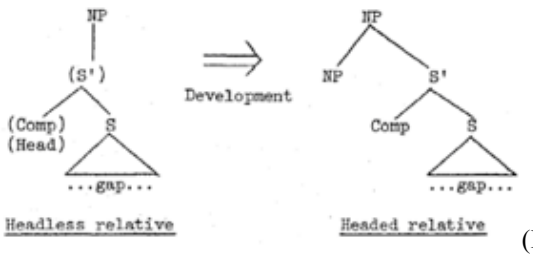
(9) a. Big Bird pushes the balloon which bumps Ernie (I: Determinate Head)
b. Ernie pushes the thing which touches Big Bird (II: Non-determinate Head)
c. Cookie Monster hits what pushes Big Bird (III: Free Relative)

Structurally, type I and type II are lexically headed relatives and type III is a free relative. Semantically, the reference of type I RC is determinate, while that of type II and type III are indeterminate.

Flynn and Lust (1981) tested 96 children between the ages of 3;06 and 7;07 with an elicited imitation task. The results showed that free relatives (III) were significantly easier for children to imitate (90% imitated correctly) than the determinate headed relatives (I) (68% imitated correctly) and non-determinate headed relatives (II) (70% imitated correctly).

This research suggested that children's early relatives might only involve a simple direct nominalization of the relativized sentence, where the head noun and the complementizer (Comp) overlapped under the node of " S' ", as in the left part of (10). In the later development, the NP head separated from the "Comp" within the phrase structure of the NP, as in the right part of (10). The headless relatives may be easier for children to learn because they allow an easy nominalization of an "S" without a separate NP head, and this nominalization can be immediately embedded as an NP in the matrix clause without differentiation of the head noun and "Comp" within the NP.

(10)



(Flynn and Lust 1980: (13))

Flynn and Lust (1981) argued that "…children do not have the full structural differentiation for recursive sentence embedding under NP until at least about the age of 6;06. The language competence of the child below this age is not identical to that of the adult. In particular, complex sentence formation in the young child involves structural hypotheses much more general than true recursive complex NP embedding which requires full head and Comp differentiation in a relative clause." (Flynn and Lust 1980: 39)

In summary, Flynn and Lust (1981) provided evidence that free relatives may be a developmental precursor to lexically headed forms in English.

Lust (1994) observed that free relatives appear to provide an intermediate form of relativization in acquisition across languages – not just English. In many languages, free relatives or headless relatives have been found to emerge as a developmental precursor to headed structures. When headed forms become available, the free relatives are also available.

In an elicited imitation experiment, Foley (1996) tested 61 French children ranging in age from 3;06 to 6;05. The study found that French RCs (both free relatives and that with lexically headed forms) matched the rate of success for the free relatives in English and free relative is a developmental precursor to lexically headed forms.

In this study, Foley compared children's correct imitation of French free relatives (e.g., 11a) with headed RCs with no semantic content of the head nouns (e.g. 11b) and headed RCs with semantic content of the head nouns (e.g., 11c).

(11) a. Gargamel mange ce que Donald prepare.
Gargamel eat-3S ce that Donald prepare-3S
'Gargamel eats what Donald prepares.'

b. Gargamel enleve la chose que Tintin recoit.
Gargamel steal-3S the-FEM thing that Tintin receive-3S
'Gargamel steals the thing that Tintin receives.'

c. Aladdin goute la soupe que Mickey aime
Aladdin taste-3S the soup that Mickey like-3S
'Aladdin tastes the soup that Mickey likes.'

Figure 4.1 presents the percentage of correct responses to the three RC types in each age group of French children. The results showed that the two lexically headed types and the free relative were imitated by children at the same high rate of success: no statistical difference appeared between any two types within French.

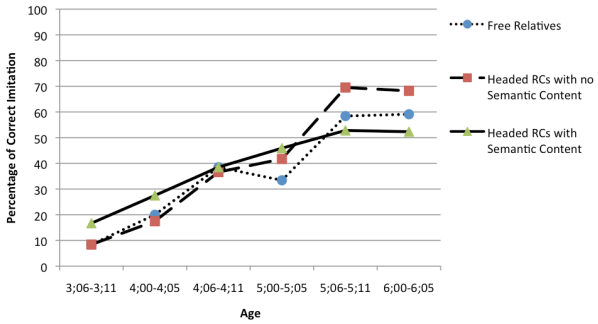


Figure 4.1: Percentage of Correct Imitation of French-speaking Children's RC Type
(From Foley 1996: p142 Figure 6.2)

These results suggest that in French, when the headed RCs develop, the free RCs are also in place. In a cross-linguistic statistical comparison with the data in Flynn and Lust (1981), Foley (1996) found that all three French structures matched the rate of success for the free relatives in English.

However, there is some difference between the free relatives in French and in English. There is an overt operator in English free relatives, such as *what* in (12b), which serves as the specifier (Spec) of CP. French free relatives, on the other hand, have a null operator (such as in 12a, it is empty in the Spec position of CP). Moreover, both lexically headed and free relatives in French include a complementizer *que* "that", as in examples (11a-c). This means that French free relatives have a similar structure as lexically headed relatives, except that there is no lexical head in free relatives, which are structurally simpler than lexically headed ones. In English, this match is less direct. The lexically headed RCs are introduced by the complementizer *that*, but the free relatives are introduced by an overt operator *what*. If the child attempts to construct the lexically headed relative on the basis of information about the free relative, the attempt will not lead to the target grammar form of the lexically headed structure.

(12) a. Gargamel mange [$_{DP}$ ce [$_{CP}$ [$_{C0}$ que] Donald prepare]]
Gargamel eat-3S ce that Donald prepare-3S
'Gargamel eats what Donald prepares'

b. Fozzie Bear hugs [$_{DP}$ [$_{CP}$ what [$_{C0}$] Kermit kisses]]

Foley (1996) claimed that the free relative form and the lexically headed form in French match more closely than that in English. If the knowledge underlying the free relative structure is present, and if the child uses this knowledge to test a hypothesis about a lexically headed structure, the hypothesized structure will match the adult grammar in headed form.

Based on the structural analysis above, Foley (1996) proposed that French children use information from the form of the free relative in constructing the form of the lexically headed relative, and that the free relative is a developmental precursor to lexically headed forms.

Flynn and Foley (2004) offered two reasons why the free relative may be developmentally primary to the corresponding lexically headed forms across languages. First, mapping to semantics from syntax is more direct in the case of free relatives. Second, free relatives may reveal more clearly the way grammar integrates independent components critical for the construction of the corresponding lexically headed forms.

In addition to English and French RCs, it is also found that free relatives emerge earlier than headed ones in Korean.

Lee (1991) studied a set of naturalistic speech data from children between the ages of 1;04 and 3;09 and found that Korean free relatives appear earlier developmentally than lexically headed relative clauses.

In children's speech from a sample of 10,627 utterances, Lee (1991) observed four basic types of RCs:

(i) a relative clause "precursor", which has neither a lexical head nor complementizer *kes*;

(ii) a relative clause structure with no lexical head, but with the complementizer *kes* (termed as free relative);

(iii) relative clause structures with a lexical head and the complementizer *kes*;

(iv) relative clauses with a lexical head and without the complementizer *kes*

Lee (1991) compared children's production of free relatives (type ii above) with that of lexically headed relatives (type iv above). The data indicated that the free relative was developmentally primary. Importantly, there were more children

producing the free relative and not the lexically headed structure than those who produced the lexically headed structure and not the free relative. Also, Lee reported that the mean age of children who produced free relatives was 27 months, while the mean age of children who produced lexically headed relative clauses (with all types of head) was 36.3 months.

In summary, studies have documented that for RCs in English, French and Korean, headless forms are acquired earlier than headed forms. In Mandarin Chinese, *de*-marked constructions (referred to as noun-modifying constructions in current study) can also be in headed or headless forms. The studies in the following sections show that the phenomenon of headed vs. headless *de*-marked forms has been a topic of major interest in the acquisition of pre-nominal *de*-marked referential expressions. Thus far, studies examining the headness of *de*-marked forms have either related the developmental phenomenon to the role of structural or functional factors during first language acquisition. The structural approach (e.g., Chang and Huang, 1986; Packard, 1988; Wang, 1996) focuses on the syntactic structure of language and highlights how structural complexity may affect children's learning processes. In this approach, a general developmental order of *de*-marked forms can be predicted by the structural complexities of various *de*-marked forms. Thus, the structure-oriented approach attributes children's omission of the head to their incompetent control of the headed *de*-marked structure. The functional approach, on the other hand, focuses on how linguistic devices serve as means for particular goals in particular contexts and how linguistic context of use may affect children's acquisition. The implication of context-dependence in the functional approach is to consider units of linguistic analyses to be larger than a sentence and to propose that language is intrinsically linked to its context of use. Therefore, the functionally-oriented approach (e.g., Cheung 1997) attempts to examine how children's sensitivity to the general discourse functions, such as information status, may affect their use of headed vs. headless *de*-marked forms in Mandarin.

4.2.2 Structural Analysis on the Acquisition of Mandarin *de* constructions

In the study on children's use of the *de*-marked constructions, Packard (1988) found evidence that children acquire headless *de* constructions before headed ones. Packard analyzed the naturalistic speech of 27 children from Taiwan. Subjects were

divided into two groups: Group 1 subjects ranged in age from 2;00 to 2;05, with a mean age of 2;03 (younger group), while Group 2 subjects ranged from 2;06 to 2;11, with a mean of 2;06 (older group). Results showed that in the younger group, only 18.7% of the *de*-modified forms contained a lexical head, while in the older group, 47.3% did. This difference is statistically significant. That is, children in the younger group showed a significant preference for *de*-modified forms without lexical heads. The children in the older group did not exhibit this preference. The author suggested "children master the use of the null-head *de* modification structure at an early age, and subsequently learn to fill in the head with a lexical item" (Packard 1988: 39).

Packard (1988) also found that children in the younger group showed a significant preference for verbal modifiers in *de* structures. Furthermore, in the speech of the children, the use of the type of modifier depends on the status of the head noun. That is, verbal modifiers were used more frequently in lexically headless *de* structures, while non-verbal modifiers were used more frequently in headed forms. Verbal modifiers referred to in Packard (1988) include adjectives (see (13a)), prepositional phrases (see (13b)) and verb phrases (see (13c)).

(13) a. 贵 的 书
gui de shu
expensive DE book
'expensive book'

b. 在 这儿 的 书
zai zher de shu
at here DE book
'books which are here'

c. 我看 的 （书）
wo kan de (shu)
I read DE (book)
'(the book) which I read'

To account for the early preference of headless forms, Packard proposed from a structural perspective that acquisition of the modifier type is not an independent process, but is dependent on the presence of the modified head noun. According to Packard (1988), the head of *de* structures is in a position of dominance over the modifier (that is, the head c-commands the modifier), regardless of whether the head is expressed or unexpressed. Furthermore, this dominance relationship depends on the form of the modifier. When the modifier is verbal, the head noun must be co-indexed

with one of the arguments (or bind the gap) in the predicate argument structure of the modifier. However, such binding relationship does not exist between a head and a nominal modifier. Thus, in adult grammar, it is the form of the modifier but not the status of the head that determines the dominance relationship.

According to Packard (1988), children at the age of group one (2;00 to 2;05) in his study were not fully sensitive to the dominance relations between a head and the modifier in adult grammar. Given this, Packard proposed that children acquired the headless forms first because they are able to consistently use a lexical head only after having developed sensitivity to binding relations. That is, the proper use of a lexical head requires full control of dominance and co-reference relations between the head and the modifier, which is yet to be present in young children at their early stage of development.

However, there are some methodological limitations of Packard's (1988) study. First, the study only had a small sample size with a total of 27 children aged between 2;00 and 2;11. These children were further divided into two age subgroups with even fewer children in each subgroup. Second, the headless forms in the study included cleft constructions (*shi…de* structure), which are ambiguous between a headless *de* structure and a construction with *de* functioning as a sentence final particle.

As for the hypothesis that children's proper use of a lexical head requires full control of dominance and binding relations between the head and the modifier, there is an L2 acquisition study that provides counterevidence.

Flynn, Foley and Vinnitskaya (2000) examined L2 English acquisition by Japanese and Spanish speakers. Results showed that for Japanese speakers, free relative forms were significantly more productive than lexically headed forms in their L2 English. In contrast, for the L1 Spanish speakers, the lexically headed types were imitated with the same high rate of success as the free relative in their L2 English. Also, there were no significant differences in either the amount or kind of errors made on headed versus headless structures in the Spanish speakers' productions. The adult L2 English findings from L1 Japanese speakers indicated that the developmental primacy of headless structures over headed structures is not limited to child Ll. If the preference of headless RCs in L1 was due to children's lack of maturation for the capacity of dominance or binding relations, then one might argue why the same

developmental tendency emerged in adult L2 as well- given that these adults should have mastered the pre-requisite knowledge of dominance or binding relations in their established L1.

In addition to Packard (1988), there are other acquisition studies (Chang and Huang 1986, Wang 1996 and Ji & Yang) examining Mandarin *de* constructions from a syntactic perspective.

For instance, Chang and Huang (1986) found that most young children started with headless *de*-marked phrases ('incomplete' in Chang and Huang (1986)) and gradually mastered the headed *de*-marked forms. Although they observed that "incomplete" *de*-marked forms appear earlier than their "complete" counterparts, there was no statistical significance found between them. According to Chang and Huang (1986), the observed order is largely determined by the syntactic complexities of *de* related structures. They simply proposed that the order of emergence of *de* structures was influenced primarily by semantic and syntactic complexities in grammatical development. The "incomplete" *de*-marked forms, such as the possessive headless *de* phrase 我的Ø *wo de Ø* "mine", the adjective headless *de* phrase 红的Ø *hong de Ø* "the red one", and the nominalized headless *de* phrase 吃的Ø *chi de Ø* "something for eating", emerged earlier because of their semantic and syntactic "simplicities".

Following Packard's proposal, Wang (1996) examined the interactional effect of the head and the modifier in the acquisition of *de*-marked constructions. Data from children's spontaneous samples and an imitation task showed that headless *de*-marked forms were easier for the children to produce. Further, whether the modifier is verbal or not played a crucial role in determining children's use of *de*-marked constructions. Wang's results show that, irrespective of the occurrence of the head, N DE (N) (I DE doll, 'my doll') emerged earliest in children's spontaneous production and V DE N (eat DE candy, 'the candy that is for eating') was the most difficult structure for children to imitate. Wang pointed out that an incompatibility of [± verbal] features between the modifier and the head in the V DE N structure exists, which is difficult for children because the modifier contains a transitive verb requiring an unspecified participant that further depends on what the head noun is.

Ji & Yang (2009) explored the emergence of *de* in Mandarin-speaking children's early NPs. It was a longitudinal study of two children's production data ranging from

00;10;05 to 02;04;31 for CY, and from 00;11;18 to 02;06;02 for ZTX. Their results show that: i) the earliest *de* constructions are "NP+*de*" without the head noun. In the following month (01;07), "VP+*de*" is attested. "AP+*de*" is also attested at 01;07 in ZTX's data, but is not attested in CY's data until a month later and ii) the majority of "NP+*de*+head" are with head NP, while the majority of "AP+*de*+head" and "VP+*de*+head" are headless forms. Ji & Yang (2009) suggested that their data support the continuity hypothesis of L1 acquisition. The hypothesis suggests that "NP *de*" was acquired earlier than "VP *de*" and "AP *de*" and, whether the head noun was expressed or not has a relation with the form of the modifier.

4.2.3 Pragmatic Analysis on the Acquisition of Mandarin *de* Constructions

Cheung (1997) analyzed discourse functions of *de*-marked forms in children's narrative data. Contradicting Packard's observation, Cheung's results showed that both younger (4-year-olds) and older (6-year-olds) groups of children used few headless *de*-marked phrases in the narrative samples. Nevertheless, children's use of headless *de*-marked forms was mostly to situate an old referent and to provide more information on the entity, which had been specified in the previous context.

This finding indicates that children are sensitive to the function of headless *de*-marked forms and points to the possibility that the use between headed and headless *de*-marked phrases may be related to the information status in discourse.

It was claimed in the study of Cheng et al. (2011) that structure-based accounts are inadequate in explaining the use of *de*-marked referential expressions in mother–child conversation. Cheng et al. (2011) analyzed one mother–child dyad's longitudinal use of Mandarin headed and headless *de*-marked referential expressions in their daily conversations. The study focuses on two questions: first, whether the Mandarin *de*-marked referential expressions were associated with information status assumed by the speaker toward the addressee; and, second, whether pragmatic factors affected the use of headed and headless *de*-marked referential forms under the Given or New information distinction.

The results show that when a new and unfamiliar referent is introduced into discourse for the first time, both the mother and child used headed *de*-marked forms nearly 100% of the time. While referring to a Given referent, both mother and child primarily used headed *de*-marked forms more than headless *de*-marked forms (mother:

81.97% (headed) versus 18.03% (headless); child: 65.6% (headed) versus 34.4% (headless)). This suggests that the child, similar to the mother, displayed adult like sensitivity to the association between the *de*-marked referential form and its information status. Although no headless preference is observed in the data, a higher percentage of headless *de*-marked forms was found in child output than that of adult input (child: 65.6% to 34.4%; mother: 81.97% to 18.03%).

Cheng et al. (2011) also examined how the interactive roles and communicative acts in discourse affect the different usages of *de*-construction made by the mother and the child. In expanding utterances, the mother primarily used headed *de*-marked forms to make statements. In spontaneous utterances, the headed *de*-marked forms were primarily used for raising questions. In elicited utterances, headed *de*-marked forms were used mainly for answers; in maintaining utterances, headed *de*-marked forms were used by the mother to agree to the prior requests made by the child.

In contrast to adult, the child's interactive roles also pair with the communicative acts in a principled manner. In expanding utterances, like the mother, the child used headed *de*-marked forms for making statements, but unlike the mother in spontaneous utterances, the child used headed *de*-marked forms mainly for making requests. In elicited utterances, like the mother, the child used headed *de*-marked forms mainly for giving answers. In maintaining utterances, however, the child did not show clear patterns of communicative acts.

These results indicate that in the mother–child dyad conversations, the mother tended to play the role of an information provider, by expanding the topic with statements; or by initiating the conversation by posing questions to the child; or by giving answers and making agreements, using headed *de*-marked forms. The child's interactive roles, together with her communicative acts, show that the child - being slightly different from the mother - tended to play a more 'responsive' role. As a result, a higher percentage of the possessive headless *de*-constructions in both the child's spontaneous and expanding utterances were formed.

It was concluded in Cheng et al. (2011) that the differing interactive roles played and communicative acts performed by the mother and child can largely explain their use of headed and headless *de*-marked referential expressions. Further, the child's developmental course of *de*-marked referential expressions is thus constrained by

these two factors: the role of the information provider played by the mother and the active role assumed by the child herself. Finally, it was assumed in the study that the function of *de*-marked referential expressions is used not only for referring to entities in the world and in context but also for achieving interlocutors' intentions.

Although the function of adult input is taken into account in the study of Cheng et al. (2011), there is only one child-mother pair being investigated. The data is not sufficiently representative to draw conclusions about children's developmental pattern in acquiring Chinese *de* constructions.

In summary, most of the studies introduced above examined children's acquisition of Chinese *de* constructions from the structural perspective, the majority of which found a headless preference. On the other hand, very few studies are from a discourse-functional perspective and they did not report a headless preference. However, other researchers (e.g., Bates and MacWhinney 1982; Slobin 1985) have suggested that function also plays an influential role in language acquisition. Given this context, the current study revisits the topic of children's acquisition of the headness of Mandarin NMCs from a semantic/functional perspective, which will be introduced in Section 4.3 to follow.

4.3 Methodology of the Current Study

The data analyzed in this study came from the same corpus as that in Study 1 and Study 2 (i.e., corpus "Zhou2" deposited at the Child Language Data Exchange System (CHILDES) archive, which is downloadable at: http://childes.psy.cmu.edu/data/EastAsian/Chinese/). Please see section 2.3.1 in Chapter Two for the introduction of CHILDES and the corpus "Zhou2".

In Study 1 (introduced in Chapter Two), by using the program CLAN and the standard search tool KWAL, 5026 utterances with 的 *de* were retrieved from 276 files featuring 135 mother-child pairs. The output files were converted into Microsoft Excel format for further manual coding and disambiguation. After excluding the irrelevant phrases with 的 *de* in Study 2 (introduced in Chapter Three), there are 3549 NMCs altogether, including 850 NMCs produced by 135 children and 2699 NMCs attested in the mother-to-child speech in the same corpus.

All the 3549 NMCs are classified into two different types according to whether they are with or without a lexical head noun. The former are called headed NMCs (see example 14 a) and the later are headless NMCs (see example 14 b).

(14) a. 我 喜欢 玩 的 玩具 在 这儿 (Headed NMC)
wo xihuan wan de wanju zai zher
I like play DE toy at here
'the toy that I like to play is here.'

b. 我 喜欢 玩 的 在 那儿 (Headless NMC)
wo xihuan wan de zai nar
I like play DE at there
'the one(s) that I like to play is there.'

In addition to the classification of the headed and headless NMCs, all the NMCs with formal and constitutive quale are further coded into different qualia subtypes. Major subtypes of formal NMCs include Color, Shape, Magnitude and Location (see example 15 a-d), and major subtypes of constitutive NMCs include Parts, Has, Relation and Quality (see example 16 a-d).

(15) a. 红色 的 （积木） (Color)
hongse de (jimu)
red DE (building blocks)
'red (building blocks)'

b. 圆 的（图形） (Shape)
yuan de (tuxing)
round DE (graphs)
'round (graphs)'

c. 大 的（苹果） (Magnitude)
da de (pingguo)
big DE (apple)
'big (apple)'

d. 天上 的 星星 (Location)
tianshang de xingxing
in the sky DE stars
'stars in the sky'

(16) a. 兔子 的 脚 (Parts)
tuzi de jiao
rabbit DE feet
'rabbit's feet'

b. 我 的 帽子 (Has)
wo de maozi
I DE hat
'my hat'

c. 园园　　的 爸爸　　(Relation)
yuanyuan de baba
Yuanyuan DE father
'Yuanyuan's father'

d. 新　的（书包）　　(Quality)
xin de (shubao)
new DE (school bag)
'new (school bag)'

4.4 Results

4.4.1 Distribution of the Headless and Headed NMCs

Table 4.1 lists the distribution of the headless and headed NMCs in child output and adult input from the age 3;00 to 6;00.

Table 4.1: Distribution of the Headless and Headed NMCs in Child Output and Adult Input at Different Ages

Speaker	Age	NMCs			
		Headless		Headed	
		Token	%	Token	%
Child	3;00 (20*)	82	73.2	30	26.8
	3;06 (21)	64	59.8	43	40.2
	4;00 (16)	82	61.7	51	38.3
	4;06 (19)	61	58.1	44	41.9
	5;00 (22)	76	54.3	64	45.7
	5;06 (16)	65	56.5	50	43.5
	6;00 (21)	58	42.0	80	58.0
Adult	3;00 (20)	226	45.4	272	54.6
	3;06 (21)	175	37.9	287	62.1
	4;00 (16)	184	45.2	223	54.8
	4;06 (19)	156	39.9	235	60.1
	5;00 (22)	147	41.1	211	58.9
	5;06 (16)	81	37.2	137	62.8
	6;00 (21)	144	39.5	221	60.5

*The number in parentheses indicates the number of children who have produced at least 1 NMC in that age group.

Results indicate that there are significant differences in the distributions at different ages between headless and headed NMCs [$x^2=26.642$, df=6, $p=.000<.001$] in child output. On the other hand, there are no significant effects in adult output between headless and headed NMCs [$x^2=10.602$, df=6, $p=.101>.05$].

According to the results, children produce more headless NMCs than headed ones from the age of 3;00 to 5;06. At age 6;00, however, children started to produce

more headed NMCs than headless ones, similar to the production pattern in the adult input.

Figure 4.2 illustrates the decrease of children's production of headless NMCs and the increase of headed forms at different ages. The figure shows that children's percentage of use of the two forms of NMCs are similar at ages 5;00 and 5;06. At age 6;00, the percentage of use of headed NMCs is even higher than that of headless forms.

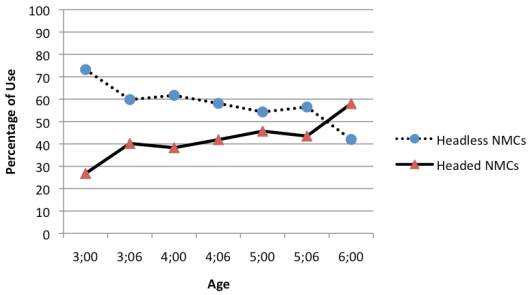


Figure 4.2: Use of Headed and Headless NMCs in Child Output at Different Ages

Figure 4.3 illustrates the percentage of the use of headed and headless NMCs in adult input. Results show that adults produce more headed than headless NMCs when speaking to children in each age group.

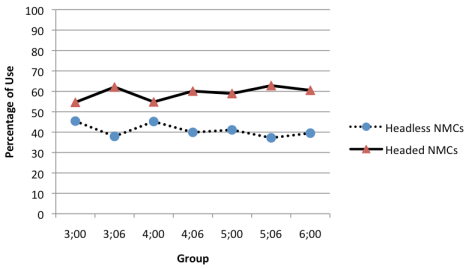


Figure 4.3: Use of Headed and Headless NMCs in Adult Input in Different Groups

4.4.2 Qualia Role of the Headed vs. Headless NMCs

In Chapter Three, the roles of qualia structures played in NMCs' acquisition and its developmental pattern in Mandarin Children were examined. It was found that NMCs with formal qualia relation (e.g., 蓝色的笔 *lanse de bi* 'Blue pen'，方方的盒子 *fangfang de hezi* 'Square box') are produced more frequently than NMCs with Constitutive relation (e.g. 衣服上的扣子 *yifushang de kouzi* 'Clothes buttons'，它的嘴巴 *ta de zuiba* 'Its mouth'). While NMCs with Telic (e.g. 玩儿的东西 *wanr de dongxi* 'Things for playing') and Agentive (e.g. 太阳的光 *taiyang de guang* 'Light of

the sun') relations are attested very late. The current study found that the headness of NMCs is related to the qualia relation between the modifier and the head noun, which is discussed in the following subsections.

4.4.2.1 Qualia Relations in Headless and Headed NMCs

Table 4.2 summarizes distribution of the qualia relations in headless and headed NMCs in child speech at different ages.

Table 4.2: Distribution of Qualia Structure of Headless and Headed NMCs in Child Speech at Different Ages

Age	Qualia	Headness			
		Headless		Headed	
		Token	%	Token	%
3;00	Formal	63	82.89	13	17.11
	Constitutive	6	28.57	15	71.43
	Agentive	12	85.71	2	14.29
	Telic	1	100.00	0	0.00
3;06	Formal	56	73.68	20	26.32
	Constitutive	2	9.09	20	90.91
	Agentive	3	50.00	3	50.00
	Telic	3	100.00	0	0.00
4;00	Formal	59	80.82	14	19.18
	Constitutive	13	31.71	28	68.29
	Agentive	7	100.00	0	0.00
	Telic	3	25.00	9	75.00
4;06	Formal	50	79.37	13	20.63
	Constitutive	6	21.43	22	78.57
	Agentive	2	40.00	3	60.00
	Telic	3	33.33	6	66.67
5;00	Formal	55	74.32	19	25.68
	Constitutive	8	16.67	40	83.33
	Agentive	8	72.73	3	27.27
	Telic	5	71.43	2	28.57
5;06	Formal	32	66.67	16	33.33
	Constitutive	13	33.33	26	66.67
	Agentive	16	76.19	5	23.81
	Telic	4	57.14	3	42.86
6;00	Formal	38	58.46	27	41.54
	Constitutive	6	12.77	41	87.23
	Agentive	10	58.82	7	41.18
	Telic	4	44.44	5	55.56

Results show that, there is significant difference in the distribution of the four qualia relations between headless and headed NMCs [$\chi 2=190.500$, df=3, p=.000]

across all age groups. In headless NMCs, formal NMCs are produced significantly more than constitutive ones. Whereas in headed NMCs, formal NMCs are produced significantly less than constitutive ones. Figure 4.4 illustrates the distribution pattern of children's production of headed vs. headless NMCs with formal and constitutive quale. The data show that children use formal NMCs more in headless form, and use constitutive NMCs more in headed form.

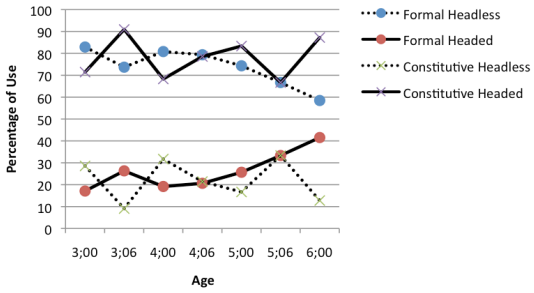


Figure 4.4 Use of Headed and Headless Formal and Constitutive NMCs in Child Speech at Different Ages

Table 4.3 in the following describes the distribution of the four qualia relations in headless and headed NMCs in the adult input. The results show that there is a significant difference in the distribution of the four qualia relations between headless and headed NMCs [$\chi 2$=408.300, df=3, p=.000]. In headless NMCs, formal NMCs are produced more than constitutive ones. Whereas in headed NMCs, formal NMCs are produced less than constitutive ones.

Table 4.3: Distribution of Qualia Structure of Headless and Headed NMCs in Adult Input in Different Groups

Group	Qualia	Headness			
		Headless		Headed	
		Token	%	Token	%
3;00	Formal	164	62.60	98	37.40
	Constitutive	15	9.93	136	90.07
	Agentive	28	63.64	16	36.36
	Telic	19	46.34	22	53.66
3;06	Formal	128	53.56	111	46.44
	Constitutive	11	7.59	134	92.41
	Agentive	33	54.10	28	45.90
	Telic	3	17.65	14	82.35
4;00	Formal	138	65.71	72	34.29
	Constitutive	14	11.20	111	88.80
	Agentive	27	60.00	18	40.00
	Telic	5	18.52	22	81.48
4;06	Formal	105	51.72	98	48.28
	Constitutive	15	15.31	83	84.69

	Agentive	30	46.88	34	53.13
	Telic	6	23.08	20	76.92
5;00	Formal	82	46.07	96	53.93
	Constitutive	22	21.15	82	78.85
	Agentive	36	65.45	19	34.55
	Telic	7	33.33	14	66.67
5;06	Formal	40	41.67	56	58.33
	Constitutive	4	5.56	68	94.44
	Agentive	28	80.00	7	20.00
	Telic	9	60.00	6	40.00
6;00	Formal	60	37.27	101	62.73
	Constitutive	25	21.55	91	78.45
	Agentive	42	71.19	17	28.81
	Telic	17	58.62	12	41.38

Figure 4.5 illustrates the distribution pattern of adults' production of headed and headless NMCs with different qualia structures in child-directed speech. The data show that adults produce constitutive NMCs more in headed form when speaking to children of different age groups.

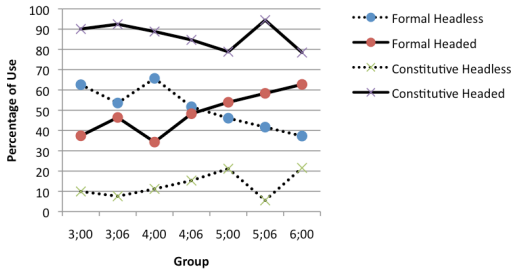


Figure 4.5 Use of Headed and Headless Formal and Constitutive NMCs in Adult Input in Different Groups

4.4.2.2 Developmental Pattern of Formal Qualia Relations in Headless and Headed NMCs

Figure 4.6 illustrates the decrease in the use of formal headless NMCs and the increase in the use of formal headed form when age increases. Percentage of use of the two forms becomes similar at age 6;00. This tendency is similar to the general tendency of the use of headless vs headed NMCs (collapsed across subtypes) in child output (see Figure 4.2).

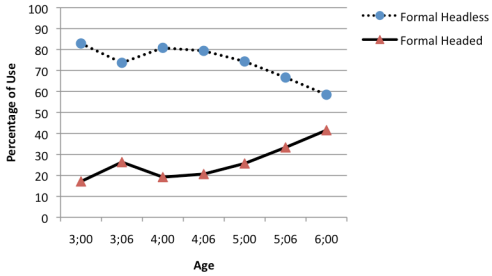


Figure 4.6: Use of Headed and Headless Formal Qualia NMCs in Child Speech at Different Ages

Figure 4.7 illustrates the results of formal NMCs in the adult input. Although adults produce more headless NMCs with formal quale in two groups (3;00 and 4;00), the profile of the use of formal NMCs in adult input is still largely different from the developmental usage patterns in child output in Figure 4.6.

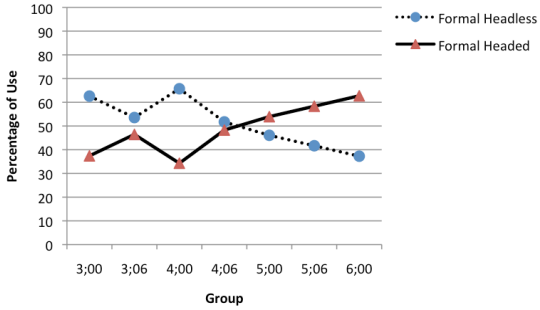


Figure 4.7: Use of Headed and Headless Formal Qualia NMCs in Adult Input in Different Groups

Table 4.4 in the following describes the major subtypes of formal qualia in headless and headed NMCs produced by children and adults. The data show that:

i) Production of formal NMCs in child output focuses mainly on the subtypes of Color, Shape, Magnitude and Location. Production of Color, Shape and Magnitude type NMCS are mostly in headless form, while almost 70% NMCs of Location type are in headed form.

ii) Production of formal NMCs in adult input focuses also mainly on the subtypes of Color, Shape, Magnitude and Location. Production of Color, Shape and Magnitude type NMCS are mostly in headless form, while more than 75% of Location NMCs are produced in headed form. Profile is similar between adult input and child output in this respect.

Table 4.4: Distribution of Subtypes of Formal Qualia in Headless and Headed NMCs in Child Output and Adult Input

Speaker	Formal	Headless		Headed	
		Token	%	Token	%
Child	Color	201	86.3	32	13.7
	Shape	84	79.2	22	20.8
	Magnitude	43	68.3	20	31.7

	Location	16	32.7	33	67.3
Adult	Color	316	69.3	140	30.7
	Shape	223	71.5	89	28.5
	Magnitude	90	57.3	67	42.7
	Location	57	22.8	193	77.2

Figure 4.8 illustrates the usage patterns of the major subtypes of formal NMCs consistent across child output and adult input.

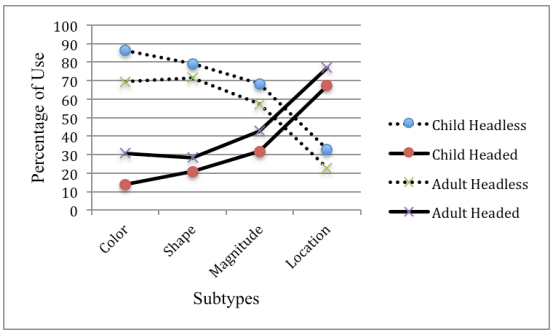


Figure 4.8: Use of Headed and Headless NMCs of Formal Qualia Subtypes

4.4.2.3 Developmental Pattern of Constitutive Qualia Relations in Headless and Headed NMCs

In contrast, production of headless versus headed forms of constitutive NMCs are quite different from that of formal NMCs.

Figure 4.9 illustrates the results of constitutive qualia NMCs in child output. Headed forms are used more than headless forms across ages. This profile specific to the constitutive quale is different from the overall pattern of the use of headed vs headless NMCs.

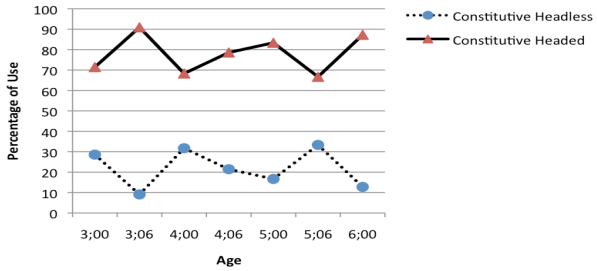


Figure 4.9: Use of Headed and Headless Constitutive Qualia NMCs in Child Output at Different Ages

Figure 4.10 illustrates the results of constitutive qualia NMCs in adult input. Headed forms are used more than headless forms across groups, similar to the patterns in child output.

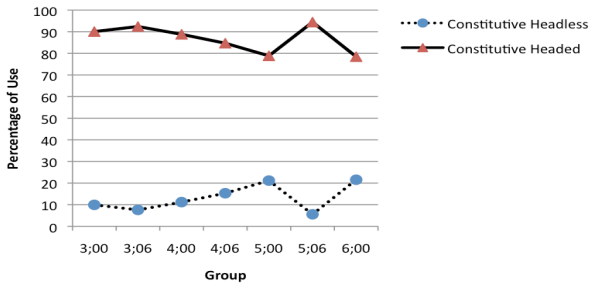


Figure 4.10: Use of Headed and Headless Constitutive Qualia NMCs in Different Groups of Adult Input

Table 4.5 in the following describes the major subtypes of constitutive qualia in headless and headed NMCs produced by children and adults. The data show that:

i) Constitutive NMCs in child output are mainly the subtypes of Parts, Has, Quality and Relation. It is interesting to observe that Parts, Has and Relation type NMCs are mostly produced in headed form, while more than 50% of Quality type NMCs are in headless form.

ii) Constitutive NMCs in the adult input are mainly the subtypes of Parts, Has, Relation and Quality. Among the subtypes of constitutive NMCs in the adult input, Parts, Has and Relation type NMCs are mostly produced in headed form, and there is no significant difference between headless Quality NMCs and headed Quality NMCs.

Table 4.5: Distribution of Subtypes of Constitutive Qualia in Headless and Headed NMCs in Children's Output and Adult's Input

Speaker	Constitutive	Headless		Headed	
		Token	%	Token	%
Child	Parts	4	4.2	92	95.8
	Has	21	27.6	55	72.4
	Relation	1	6.2	15	93.8
	Quality	13	68.4	6	31.6
Adult	Parts	5	1.9	259	98.1
	Has	49	23.6	159	76.4
	Relation	1	1.9	52	98.1
	Quality	21	46.7	24	53.3

Figure 4.11 shows the usage profile of the major subtypes of constitutive NMCs consistent across child output and adult input.

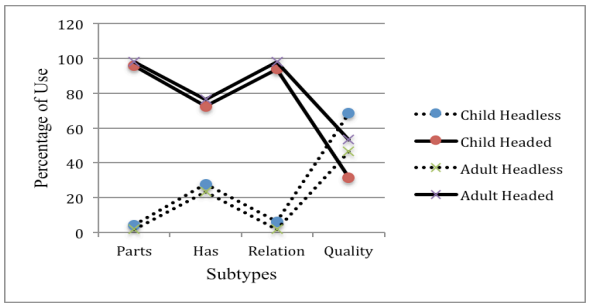


Figure 4.11: Use of Headed and Headless NMCs of Constitutive Qualia Subtypes in Child Output and Adult Input

4.4.3 Headless vs. Headed RCs

It is found in section 4.4.1 that the earliest NMCs in child Mandarin are frequently headless formal non-RC type; followed by headed constitutive non-RC type NMCs; and then RC-type NMCs. As for RC type NMCs, object RCs are found being more frequently used than subject RCs in child naturalistic speech. One interesting question is: are these early RCs in child naturalistic speech mostly headed or headless? This section examines the headness of the RCs attested in young Mandarin-speaking children's naturalistic speech.

Results show that headless RCs were used more frequently than headed RCs (83.33% vs. 16.67%) in child naturalistic speech at age 3;00, indicating a clear headless advantage. However, this headless advantage is not attested in adult child-directed speech (see Table 4.6).

Table 4.6 Distribution of the Use of Headed vs. Headless RCs in Child Speech and Adult Child-directed Speech

Speaker	Age	RCs			
		Headed		Headless	
		Token	%	Token	%
Child	3;00 (7/20)	2	16.67	10	83.33
	3;06 (6/21)	3	42.86	4	57.14
	4;00 (9/16)	12	60	8	40
	4;06 (9/19)	7	58.33	5	41.67
	5;00 (12/22)	5	25	15	75
	5;06 (9/16)	2	7.4	25	92.59
	6;00 (8/21)	11	50	11	50
	Total (60/135)	42	35.00	78	65.00
Adult	3;00 (17/20)	35	42.17	48	57.83
	3;06 (20/21)	56	57.14	42	42.86
	4;00 (15/16)	57	67.86	27	32.14
	4;06 (17/19)	63	66.32	32	33.68
	5;00 (21/22)	46	52.27	42	47.73
	5;06 (16/16)	40	57.14	30	42.86
	6;00 (20/21)	43	44.79	53	55.21
	Total (126/135)	340	55.37	274	44.63

It has been reported in section 4.4.2 that most formal NMCs are produced in headless form and constitutive NMCs are in headed form. As for agentive and telic NMCs, there was no clear pattern due to limited number of tokens. Within the 120 RCs in child naturalistic speech, 41.67% are with the agentive quale and 22.5% are with the telic quale. One cannot simply account for the use of headed versus headless RCs in child speech from such a semantic perspective. On the other hand, it is found that most headless RCs appear in the following contexts: i) the unexpressed head nouns are old information or the RC is a response to the adult child-directed speech (see 17a); ii) the unexpressed head noun of the RC is in the here and now context (see 17b); iii) the head noun has been previously mentioned by the child in the prior discourse (see 17c); and iv) the unexpressed head noun of the RC is in the form of "…verb DE *shi* 'is'…" (called pseudo cleft in the literature) (see 17d).

(17) a. Mother: 我 给 你 买 个 机器人
wo gei ni mai ge jiqiren
I for you buy a robot
'I will buy a robot for you.'

Child: 买 能 打斗 的 (4;00)
mai neng dadou de
buy can fight DE
'buy one that can fight.'

b. 你 看 我 搭 的 (3;00)
ni kan wo da de
you look I build DE
'look, what I built.'

c. 这 是 机器人，可以 变形 的 (5;00)
zhe shi jiqiren, keyi bianxing de
this be robot can be transformed DE
'This is a robot that can be transformed.'

d. 我 做 的 是 小火车 (3;00)
wo zuo de shi xiaohuoche
I make DE be little train
'what I made is a little train'

For example, in the age 3;00 group, 6 out of 10 (60%) headless RCs have an unexpressed noun which appears in the here and now context (as in 17b), 2 out of 10 (20%) headless RCs are responses to the adult child-directed speech (as in 17a) and the other 2 RCs (20%) are in the form like (17d).

In the age group 5;00, 6 out of 15 (40%) headless RCs are responses to adult child-directed speech (as 17a), 4 out of 15 (27%) headless RCs are in the form of (17d), and 3 out of 15 (20%) headless RCs are with head nouns previously mentioned by the child in the prior discourse (as 17c), and for the other 2 headless RCs (13%), the referent of the head nouns appear in the here and now context (as 17b).

Similar to the 5;00 group, in the 5;06 group, 15 out of 25 (60%) headless object RCs are responses to or repetitions of the adult child-directed speech, 7 out of 25 (28%) headless object RCs are in the form like (17d), and for the other 3 headless RCs, the referent of the head nouns appears in the here and now context (as 17b).

We can see that in the 3;00 group, for 60% of children's headless RCs, the referent of the head nouns is in the here and now context. For these RCs, they can be either headed or headless. For example, (17b) can also be expressed in a headed form, such as (18):

(18) 你 看 我 搭 的 积木
ni kan wo da de jimu
you look I build DE building block
'look, the building blocks that I built.'

The data suggests that children at age 3;00 prefer to use this kind of RCs, where the referent of the head noun appears in the here and now context and is unexpressed. This may be due to the influence of the context. For example some of these RCs are also children's responses to the adult child-directed speech. Children's language competence may have a role too, since some of these RCs are to initiate a new topic and a headed form should be used.

From the data in the 5;00 and 5;06 groups, we can see that most headless RCs are responses to adult child-directed speech, or in the form like (17d). Discourse is an important factor influencing the frequent use of headless RCs in young children.

When we look further into subject RCs and object RCs separately, the data show that children produced more headless RCs than headed RCs for both subject (69.23% vs. 30.77%) and object RCs (61.73% vs. 38.27%). On the contrary, in adult child-directed speech, more headed than headless RCs were attested for subject RCs (66.89% vs. 33.11%), and there is no significant difference between headed and headless RCs for object RCs (51.62% vs. 48.38%) (see Table 4.7).

Table 4.7 Distribution of the Use of Headed vs. Headless RCs for Subject vs. Object RCs in Child Speech and Adult Child-directed Speech

Speaker	Age	Subject RC				Object RC			
		Headed		Headless		Headed		Headless	
		Token	%	Token	%	Token	%	Token	%
Child	3;00	1	25	3	75	1	12.5	7	87.5
	3;06	1	50	1	50	2	40	3	60
	4;00	5	55.56	4	44.44	7	63.64	4	36.36
	4;06	3	60	2	40	4	57.14	3	42.86
	5;00	0	0	7	100	5	38.46	8	61.54
	5;06	0	0	8	100	3	15.79	16	84.21
	6;00	2	50	2	50	9	50	9	50
	Total	12	30.77	27	69.23	31	38.27	50	61.73
Adult	3;00	13	40.63	19	59.37	22	43.14	29	56.86
	3;06	13	61.9	8	38.1	43	55.84	34	44.16
	4;00	18	78.26	5	21.74	39	63.93	22	36.07
	4;06	17	80.95	4	19.05	46	62.16	28	37.84
	5;00	14	77.78	4	22.22	32	45.71	38	54.29
	5;06	10	83.33	2	16.67	30	51.72	28	48.28
	6;00	16	66.67	8	33.33	27	37.5	45	62.5
	Total	101	66.89	50	33.11	239	51.62	224	48.38

However, it is found that only the children at ages 3;00, 5;00 and 5;06 exhibit such robust headless preference for either subject or object RCs. The figures in Table 4.7 suggest that at age 3;00, the earliest object RCs are mostly headless. As for ages 5;00 and 5;06, although higher percentage of subject than object RCs are in headless form, most subject headless RCs were responses to or repetitions of the adult child-directed speech, which could be accounted for by discourse-pragmatic factors.

Overall, the data suggest that children use headless RCs more frequently than headed RCs. This is consistent with the pattern that earliest NMCs in child Mandarin are frequently headless forms. In other words, headless advantage apply to both RC type and non-RC type NMCs.

Children use headless RCs more frequently than headed forms, no matter it is for subject or object RCs. The current data therefore suggest that the use of headed vs headless RCs does not seem to be influenced by the syntactic function of the head noun (i.e. subject RC or object RC). This result is consistent with the other findings in this study that the use of headed vs headless NMCs is not influenced by the syntactic features of the structure, but relates to the semantic relation between the modifiers and the head nouns and discourse-pragmatic reasons.

4.4.4 Summary of Findings

Results in the current study indicate that:

i) Children produce more headless NMCs than headed ones from the age of 3;00 to 5;06. At age 6;00, children produce more headed NMCs than headless ones instead. However, adults produce more headed than headless NMCs in each group.

ii) Children's production of headless NMCs decreases as age increases, while the use of headed NMCs increases with age.

iii) NMCs with formal quale in child output are mostly in headless form in each age group, and children's NMCs with constitutive quale are more in headed form in each age group. Adults use NMCs with constitutive quale mostly in headed form in each group, while NMCs with formal quale in the adult input are more in headless form in general, but not in each group.

iv) Formal NMCs in child speech are mostly subtypes of Color, Shape, Magnitude and Location. Apart from the subtype of Location, the other three types of NMCs are expressed mostly in headless form. Constitutive NMCs in child speech are mostly subtypes of Parts, Has, Quality and Relation. Apart from the subtype of Quality, the other three types of NMCs are expressed mostly in headed form.

v) Formal NMCs in adult input are also mostly subtypes of Color, Shape, Magnitude and Location. Apart from the subtype of Location, the other three types of NMCs are expressed mostly in headless form. By contrast, all the subtypes of constitutive NMCs attested in the adult input are mostly in headed form.

vi) As a subset of NMCs, RCs are also expressed more frequently in headless form in early child speech. The earliest object RCs are mostly headless. By contrast, RCs in adult child-directed speech do not exhibit a clear headless preference.

4.5 Discussion

4.5.1 Headless Preference

Results of the current study indicate that more headless NMCs than headed NMCs were attested in children's naturalistic speech. This result is consistent with the previous findings that Mandarin-speaking children prefer to use headless *de*

constructions rather than headed forms (Chang and Huang 1986, Packard 1988; Wang 1996, and Ji &Yang 2009).

The results of the current study are also in accordance with the acquisition data on the primacy of free relatives in child English, Korean and Japanese naturalistic speech, which are reported in Hamburger (1980), Lee (1991) and Murasugi (1991) respectively. Even in experimental studies, such as Flynn and Lust (1980) on child English and Packard (1988) on child Mandarin, they also found such headless preference.

4.5.2 Developmental Pattern of the Use of Headed and Headless NMCs

The current study found that in children's naturalistic speech, the use of headless NMCs decreased with age, from 73.2% (age 3;00) to 42.0% (age 6;00), while headed NMCs increased from 26.8% (age 3;00) to 58% (age 6;00). Different from the pattern found in children's speech, adults use more headed than headless NMCs when speaking to children across all the age groups.

Many studies on English (Hamburger 1980, Flynn & Lust 1980), Korean (Lee 1991), Japanese (Murasugi 1991) and Mandarin (Chang & Huang 1986, Packard 1988; Wang 1996 and Ji &Yang 2009) found that children acquire free relatives or headless Mandarin *de* constructions before they master headed forms. Based on these previous findings, results of the current study suggest that Mandarin-speaking children use headless NMCs more than headed ones before the age 5;06. At around age 6;00, children's use of headed vs headless NMCs is similar to that of adults, that is, using more headed than headless forms.

Results of the current study therefore are in general consistent with the idea that headless NMCs are acquired first, before the acquisition of a lexically headed construction. The headless form emerges as a developmental precursor to the lexically headed one.

4.5.3 Semantic Meaning and the Headness of NMCs

4.5.3.1 Possession vs Attributive Modification

Current study found that NMCs with formal quale in the child output are more in headless form in each age group, and children's NMCs with constitutive quale are

more in headed form in each age group. Since the qualia role of NMCs is based on the semantic relations between the modifiers and the head nouns, the patterns suggest that the use of headed vs headless NMCs may be related to the semantic meaning of the NMC.

According to Heine (1997), Langacker (1991, 1995), Alexiadou (2001, 2003), and Nikolaeva & Spencer (2010), the relation between the modifier and the head noun of a noun modification can be either possessive or attributive modification. Alienable possession and inalienable possession are two basic semantic types of the possessive relation. Based on this position, there are three basic types of nominal constructions expressing modification relations (as shown in 19). The three types are ways of establishing some sort of relation between the modifier and the head noun within an NP, among which possessive modification has a closer relationship between the modifier and the head noun than attributive does, especially for the inalienable possession.

(19) a. inalienable possession
b. alienable possession
c. attributive modification
(From Nikolaeva & Spencer 2010: p18)

The distinction between inalienable and alienable possessions is widespread across languages (Heine 1997; Coene & D'hulst 2003, for reviews). Inalienable possession is basically between entities that cannot be separated from their owners and those that can be. Thus, it has been suggested that kinship relations (e.g. George's mother), part–whole relations (George's arm), physical and mental states (e.g. George's fears), and derived nominals (e.g. George's singing) are all likely to be treated as inalienable. An alienable possessive relation, by contrast, depicts possessive relations between entities that are relatively independent in terms of their existence. The relation between the modifier and the head noun of attributive modification is more independent.

For example, in Chatino language (Carleton and Waksler 2000: 392), inalienable nouns include "body parts, body pain and body fluids, family members, and certain concrete possessions like houses and clothes, as well as certain abstract possessions like language and memory."

Chappell and McGregor (1996) considered that the inalienable category is labeled as ‘intimate’, ‘inherent’, ‘inseparable’, or even ‘abnormal’, while the alienable categories have been labelled ‘non-intimate’, ‘accidental’, ‘acquired’, ‘transferable’, or ‘normal’.

Chappell and McGregor (1996) propose the following four kinds of relationship that tend to be associated with inalienability:

(a) a close biological or social bond between two people (e.g. kin);
(b) integral relationship (e.g. body-parts and other parts of a whole);
(c) inherent relationship (e.g. spatial relations);
(d) essential for one's livelihood or survival.

Heine (2006) proposed a straightforward distinction: Items that cannot normally be separated from their owners are inalienable, while all others are alienable. Thus, items belonging to any of the following conceptual domains are likely to be treated as inalienable:

(a) Kinship roles.
(b) Body-parts.
(c) Relational spatial concepts, like 'top', 'bottom', 'interior', etc.
(d) Parts of other items, like 'branch', 'handle', etc.
(e) Physical and mental states, like 'strength', 'fear', etc.
(f) Nominalizations, where the ‘possessum’ is a verbal noun, for example 'his singing', 'the planting of bananas'.

In addition, Heine (2006) believes that there are a number of individual concepts in a given language that may also be treated inalienably, such as ‘name’, ‘voice’, ‘smell’, ‘shadow’, ‘footprint’, ‘property’, ‘home’, etc.

Lichtenberk (1983) and Lichtenberk et al. (2011) found that the Oceanic language group has a robust distinction system in the expression of alienable and inalienable possession. Typically included in the inalienable possession category are the following relations between possessum and possessor:

(a) kinship relations and other social/cultural relations; e.g. father, spouse, trading partner;
(b) the possessum is part of the possessor; e.g. head, nose, branch (of tree);
(c) the possessum is something emanating from the possessor’s body; e.g. sweat, smell, voice;
(d) the possessum is something on the surface of the possessor’s body; e.g. tattoo, dirt, clothing;

(e) mental organs, states, products of mental processes; e.g. mind, fear, thought;
(f) various attributes of possessors, such as name, age, height;
(g) spatial location and temporal relations, such as beside (X is beside "possessor") and after (time after "possessor time", e.g. 'after four days');
(h) the possessor is a patient or theme or stimulus in a situation, such as a blow received by the possessor or medicine for the possessor.

4.5.3.2 Subtypes of Qualia Structures and the Headness of NMCs

It is found in the current study that formal NMCs in child output include subtypes of Color, Magnitude, Shape and Location etc. Constitutive NMCs in child output are mostly subtypes of Parts, Has, Relation and Quality. According to the distinction of the semantic relations between inalienable possession, alienable possession and attributive modification, qualia subtypes of Color, Magnitude, Shape and Quality are attributive modification, and subtypes of Parts, Has, Relation and Location are inalienable possession. With this classification, one can see that most constitutive NMCs have a more closer relationship between the modifier and the head noun than formal NMCs. Unexpressing the head noun of a constitutive NMC may cause the meaning of the NMC unclear. As such, one may reasonably predict that constitutive NMCs tend to be expressed in headed form, while formal NMCs are in headless form.

4.5.4 Relations Between the Headness, ±Verbal Feature and Qualia Type of NMCs

Packard (1988), Chang & Huang (1986), Wang (1996) and Ji & Yang (2009) proposed that [±verbal] feature of the modifier will influence children's production of headed vs headless *de* constructions (see section 4.2.1). These studies found that headless NMCs mostly have a verbal modifier, while headed NMCs mostly have a non-verbal modifier. This section examines whether the current data will support this structural proposal and attempts to find whether there is a relationship between the use of headed vs headless NMCs and the [±verbal] feature of the modifier. Recall also the finding that children's NMCs expressing formal facet of the head noun's meaning are more frequently headless and NMCs expressing constitutive quale are mostly headed forms. This study also attemps to explore whether there are more non-verbal (NP) modifiers in constitutive NMCs, and more verbal (AP and VP) modifiers in formal NMCs, and whether the difference between the headness of formal and constitutive NMCs is correlated with the [±verbal] feature of the modifiers.

The following is the distribution of the [±verbal] feature and the headness feature of the formal and constitutive NMCs in child and adult speech of the current data.

Table 4.8: The Distribution of ±Verbal and Headness Feature of Formal and Constitutive NMCs in Child Output and Adult Input

Speaker	Qualia	Headed				Headless			
		+Verbal		-Verbal		+Verbal		-Verbal	
		Count	%	Count	%	Count	%	Count	%
Child	Formal	47	38.52	75	61.48	178	50.42	175	49.58
	Const	20	10.58	169	89.42	25	46.30	29	53.70
	Total	67	21.54	244	78.46	203	49.88	204	50.12
Adult	Formal	233	36.81	400	63.19	327	45.61	390	54.39
	Const	200	28.49	502	71.51	42	39.62	64	60.38
	Total	433	32.43	902	67.57	369	44.84	454	55.16

Table 4.8 shows that, in child output, more headed NMCs are with non-verbal modifiers, while there is no significant difference between verbal or non-verbal modifiers for headless NMCs. For both formal and constitutive headed NMCs, there are more non-verbal modifiers; but for headless formal and constitutive NMCs, there is no significant difference between verbal or non-verbal modifiers.

In adult input, more headed NMCs are with non-verbal modifiers, and slightly more headless NMCs are with non-verbal modifiers. For both formal and constitutive headed NMCs, there are more non-verbal modifiers; and for formal and constitutive headless NMCs, there are slightly more non-verbal than verbal modifiers.

These patterns therefore suggest that the distributional use of headed vs headless NMCs mostly is not consistent with the structural proposal that headless NMCs mostly have a verbal modifier, while headed NMCs mostly have a non-verbal modifier. The current findings cannot be fully accounted for by purely structural accounts.

4.6 Concluding Remarks

Results of this study suggest that the use of headed versus headless NMCs is related to the semantic relationship (qualia structure) between the modifier of the head noun, both in child output and in adult input. Formal NMCs are more likely used in a headless form, while constitutive NMCs are more likely used in a headed form.

Chapter Five

General Discussion

5.1 Introduction

This chapter highlights the major findings of the three studies in Section 5.2, the conclusive remarks in Section 5.3, the significance and novelties of the findings in Section 5.4, and suggestions for further research in Section 5.5.

5.2 Major Findings

The three studies yielded the following six major findings:

1) Object RCs are used more frequently than subject RCs in both child naturalistic speech and adult-to-child input.

2) NMCs (in both child output and adult input) expressing the formal facet of the head noun's meaning are most frequently produced, followed by those expressing the constitutive quale, and then the agentive or the telic quale.

3) The majority of NMCs expressing the agentive or telic quale are RC type NMCs, while the majority of NMCs expressing the formal and constitutive quales are non-RC type NMCs. RC type NMCs emerge either alongside the other non-RC type NMCs at the same time, or emerge later than non-RC type NMCs for the constitutive quale.

4) Headless NMCs are more frequently produced than headed NMCs at the early stage of children's development. This shows a clear early preference for headless over headed NMCs in children's naturalistic speech. This headless over headed asymmetry gradually diminishes as age increases.

5) The general developmental preference for headless NMCs is not attested across all semantic types of NMCs. NMCs expressing the formal facet of the

head noun's meaning are more frequently headless, while the majority of child NMCs expressing the constitutive quale are headed across all the ages observed.

6) In adult-to-child input, headed NMCs are more frequently produced than headless ones. This pattern is consistently attested in the current language samples across all age levels. That is, this pattern is robustly observed when adults speak to children of different ages.

5.3 Concluding Remarks

The current naturalistic dataset are consistent with the developmental scenario in which the earliest NMCs in child Mandarin are frequently headless formal non-RC type, which are structurally and semantically less complex; followed by headed constitutive non-RC type NMCs; and then RC-type NMCs, with object RCs used earlier and more frequently than subject RCs. These findings are consistent with the idea that in Asian languages such as Japanese, Korean and Chinese, RCs develop from attributive constructions specifying a semantic feature of the head noun in acquisition (Diessel 2007, c.f. also Comrie 1996, 1998, 2002). The current findings are also consistent with the usage-based acquisition account in that constructions that are simpler structurally and/or semantically are acquired earlier than the more complex ones and that input frequency would influence the acquisition trajectory .

5.4 Significance

We highlight the significance and novelties of the three studies as follows. The current new dataset in Study 1 adds to the growing body of literature that object RCs are not necessarily more difficult than subject RCs in acquisition cross-linguistically. The current findings based on a much larger sample size at a comparatively later age strengthen the empirical claims reported in a very recent corpus study by Chen & Shirai (2014). Taken these two corpus studies together, it is reasonable to establish the

claim that (i) direct object relatives emerge early and remain to be more frequently used than subject RCs in child Mandarin naturalistic speech; and (ii) direct object relatives are also more frequently used than subject relatives in adult Mandarin child-directed speech, when caregivers speak to their Mandarin-speaking children throughout the preschool years. This evidence is robustly attested across the two studies.

Study 2 takes into account not only RCs but also other NMCs (emphasizing the typological nature of RCs as attributive clauses). To my knowledge this study is the first study that documents the usage and developmental patterns of RC type and non-RC type NMCs in child Mandarin naturalistic speech and adult Mandarin child-directed speech. The study examined the semantic characteristics of Mandarin NMCs in light of the Generative Lexicon theory. Specifically, the study characterized the semantic relations between the modifier and the head noun of the NMCs attested, according to the 4 major roles of qualia structure (Formal, Constitutive, Agentive and Telic), based on the generative lexicon framework (Pustejovsky 1995). It is probably the first attempt to apply the Generative Lexicon theory, a theory that figures prominently in natural language processing, to the field of child language acquisition. The new data and the observed developmental patterns may serve as a basis or reference for inspiring more experimental work examining the acquisition of NMCs from a semantic approach. Such cross-linguistic findings may reveal some robust descriptive generalizations about the acquisition of NMCs from a semantic perspective.

Existing studies examining the issue of headness of RCs and Mandarin *de* constructions are mostly from a structural perspective. Interestingly, results from Study 3 indicated that the general developmental preference for headless NMCs is not attested across all semantic types of NMCs. For instance, whereas child NMCs expressing the formal facet of the head noun's meaning are more frequently headless; in striking contrast, the majority of child NMCs expressing the constitutive quale are headed across all the ages observed. Similar pattern was also observed in the input data. Such developmental phenomenon seems difficult to be accounted for by purely syntactic accounts (Flynn &

Foley 2004; Packard 1988). Current findings suggest that the semantic characteristics of NMCs influence the use of headed versus headless NMCs in both acquisition and adult input.

5.5 Suggestions for Future Research

The corpus findings from Study 1 and Chen & Shirai (2014) indicating an object advantage are difficult to square with experimental studies such as Lee (1992), Cheng (1995) and Hsu et al (2009) pointing to a subject advantage. Why different studies/methods, different results?

Before attempting to address this question, one should first take note of the fact that there appear to be methodological limitations with these "subject advantage" studies, so their findings should be interpreted with caution. The act-out comprehension tasks used in Lee (1992) and Cheng (1995) did not provide a felicitous condition for the use of restrictive RCs. The elicited production study in Hsu et al (2009) included both intransitive and transitive verbs in their subject RC sentence stimuli. They did not report a direct comparison between subject transitive RCs and direct object transitive RCs. As subject intransitive RC sentence stimuli are structurally simpler, one might wonder whether merging both subject intransitive and subject transitive RC stimuli in one single "subject RC condition" might give rise to an apparent advantage for the subject RC condition.

This means that as future research, we need experimental studies on child Mandarin that provide a felicitous context for the use of restrictive RCs. We also need an elicited production study similar to Hsu et al (2009) but compare between subject transitive RCs and direct object transitive RCs.

Second, it is enlightening to observe that the kind of subject and object RC examples attested in children's naturalistic speech as reported by the current study 1 and Chen & Shirai (2014) differ quite a lot from the kind of subject and object RC test stimuli used in previous experimental studies (Table 5.1 on the next page). Semantically reversible

relatives are infrequently attested in child naturalistic speech and the adult input data, and the direct object RCs used in child and adult child-directed naturalistic speech mostly involve transitive verbs that express prototypical causative events involving an animate agent and an inanimate patient (such as *paint*, *build*, *eat, wear*). This means that with the presence of animacy cues, these direct object RCs used in naturalistic speech are also easier to process than the semantically reversible direct object RC stimuli used in experimental studies with animacy cues neutralized. Likewise, the verbs (e.g. '*have*') that appear in the subject RCs used in children's naturalistic speech are also different from the activity/actional verbs commonly used in the semantically reversible subject RC stimuli in experimental studies. Future research using for instance elicited imitation method can systematically compare between these two conditions (c.f. Kidd et al 2007): (i) one condition using subject and object RC test stimuli that match closely (in terms of verb types and/or animacy cues) to those found in corpus studies; and (ii) the other condition using subject and object RC test stimuli that are similar to those used in previous experimental studies, to revisit the issue of subject-object asymmetry in the acquisition of Mandarin RCs.

Table 5.1: Subject and Object RC examples in Experimental Studies and Corpus Studies

Study	Subject RCs		Object RCs	
	Verbs	RC Examples	Verbs	RC Examples
Chang (1984)	追 zhui chase	追 公车 的 小汽车 zhui gongche de xiaoqiche chase bus DE car 'the car that chases the bus'	追 zhui chase	公车追的小汽车 gongche zhui de xiaoqiche bus chase DE car 'the car that the bus chases'
	撞 zhuang knock	撞 吉普车 的 小汽车 zhuang jeep de xiaoqiche knock into jeep DE car 'the car that knocks into the jeep'	撞 zhuang knock	吉普车撞的小汽车 jeep zhuang de xiaoqiche jeep knock into DE car 'the car that the jeep knocks into'
	咬 yao bite	咬 小象 的 小狗 yao xiaoxiang de xiaogou bite elephant DE dog 'the dog that bites the elephant'	咬 yao bite	小象咬的小狗 xiaoxiang yao de xiaogou elephant bite DE dog 'the dog that the elephant bites'
	踢 ti kick	踢 小马 的 小狗 ti xiaoma de xiaogou kick horse DE dog 'the dog that kicks the horse'	踢 ti kick	小马踢的小狗 xiaoma ti de xiaogou horse kick DE dog 'the dog that the horse kicks'
Lee (1992)	抱 bao hug	抱着小熊的白兔 baozhe xiaoxiong de baitu hug teddy-bear de rabbit	抱 bao hug	小熊抱着的白兔 xiaoxiong baozhe de baitu teddy-bear hug DE rabbit

		‘the rabbit that hugs the teddy-bear’		‘the rabbit that the teddy-bear hugs’
	背 bei carry	背着猴子的小熊 beizhe houzi de xiaoxiong carry-on-back monkey DE bear ‘the bear that carries the monkey on its back’	背 bei carry	猴子背着的小熊 houzi beizhe de xiaoxiong monkey carry-on-back de bear ‘the bear that the monkey carries on its back’
	踢 ti kick	踢白兔的小狗 ti baitu de xiaogou kick rabbit DE dog ‘the dog that kicks the rabbit’	踢 ti kick	白兔踢的小狗 baitu ti de xiaogou rabbit kick DE dog ‘the dog that the rabbit kicks’
	踩 cai step-on	踩小狗的猴子 Cai xiaogou de houzi Step-on dog DE monkey ‘the monkey that steps on the dog’	踩 cai step-on	小狗踩的猴子 Xiaogou cai de houzi dog step-on DE monkey ‘the monkey that the dog steps on’
Hsu et al. (2009)	画画 huahua paint	画画的女孩 huahua de nvhai paint de girl ‘the girl who is painting’		
	唱歌 change sing	唱歌的女孩 change de nvhai sing DE girl ‘the girl who is singing’		
	喜欢 xihuan like	喜欢小狗的女孩 xihuan xiaogou de nvhai like dog DE girl ‘the girl who likes the dog’	喜欢 xihuan like	女孩喜欢的小狗 nvhai xihuan de xiaogou girl like DE dog ‘the dog that the girl likes’
	追 zhui chase	追猫咪的女孩/小狗 zhui maomi de nvhai/dog chase cat DE girl/dog ‘the girl/dog that chases the cat’	追 zhui chase	女孩/小狗 追的猫咪 Nvhai/dog zhui de maomi girl/dog chase DE cat ‘the cat that the girl/dog chases’
Ning & Liu (2009)			下 xia lay	黄鸡下的蛋 huangji xia de dan yellow hen lay DE egg ‘the egg that the yellow hen lays’
Chen & Shirai (2014)	有 you have	有 圆圈 的那个 you yuanquan de na ge have circle DE that CL ‘that one that has circles’	穿 chuan wear	我穿 的那 蓝的 裤子 wo chuan de na lande kuzi I wear DE that blue pants ‘the blue pants that I wore’
Current Study	同/跟/像…一样 tong/gen/xiang…yiyang same as	像这个一样的（颜色） xiang zhege yiyang de (yanse) as this same DE (color) ‘(the color) that is same as this’	画 hua paint	（我）画的房子 (wo) hua de fangzi (I) paint DE house ‘the house that (I) paint’
	可以/会/能 keyi/hui/neng may/can	可以飞的天鹅 keyi fei de tian’e can fly DE swan ‘the swan that can fly’	搭 da build	（我）搭的球 (wo) da de qiu (I) build DE ball ‘the ball that (I) built’
	有 you have	有果子的树 you guozi de shu have apple DE tree	拿 na hold	（我）拿的笔 (wo) na de bi (I) hold DE pen

		‘the tree that has apples on it’		‘the pen that (I) hold’
			吃 chi eat	吃的东西 chi de dongxi eat DE thing ‘the thing that is for eating’
			玩 wan play	玩的东西 wan de dongxi play DE thing ‘the thing that is for playing’

Still, one factor that might likely contribute to the mixed findings observed in the Mandarin RC acquisition literature is the methods themselves: different methods tap into different underlying processes as different methods test different aspects of sentence processing. For example, comprehension tasks (e.g., picture pointing task, act-out task) test the head noun referent assignment, while production tasks (e.g., elicited production task) are more concerned about whether children can formulate an RC to describe the intended referent. Future research should directly compare between methods ideally using a within-subject study design. Getting multiple sources of evidence from the same subjects also allows us to document a profile of different aspects of sentence processing. It is also relevant to point out that the mixed findings from previous acquisition studies in the literature not only come from different methods but also different subjects, so the mixed findings may be partly attributed to individual variations. Using the same subjects thus allows a direct comparison between methods.

In addition, as stated in chapter 3, experimental tasks such as elicited production and imitation tasks are suggested to systematically elicit the four types of NMCs (formal, constitutive, agentive and telic) within each type of which varying in structural complexity (involving both clausal and non-clausal modifiers, for instance) to fully consider and evaluate the role of structural complexity.

Findings from Study 3 also suggest that the early headless preference cannot be simply accounted for by input frequency. Consistent with previous findings (Flynn & Foley 2004; Packard 1988), the children showed a clear early preference for headless over

headed NMCs in their speech, with headless structures more frequently produced than headed structures at the early stages of development. As age increases, this headless over headed asymmetry gradually diminishes. This preference for headless structures, however, does not appear in the adult input data. Future research should explore to what extent to this is related to (i) the conversational style between young children and their caregivers (with caregivers being more 'initiative' and as such being more often introducing new referents and topics for instance (hence more frequent use of headed forms) and young children at an early age being more 'responsive' and as such being more often responding to the questions asked about old referents and/or talking about established topics that license dropping the head noun; and/or (ii) the incomplete linguistic competence by young children at this syntax-pragmatics interface (more in-depth corpus analyses and elicited production tasks are needed to evaluate whether children's use of headless and headed forms are adult-like or not given the felicitous discourse contexts).

Reference

Abbot-Smith K., Lieven E. & Tomasello M. 2008. Graded representations in the acquisition of German andEnglish transitive constructions. Cognitive Developmmt 23: 48-66.

Alexiadou A. 2001. Adjective syntax and noun raising: word order asymmetries in the DP as the result of adjective distribution. Studia Linguistica 55, 217-248.

Alexiadou A. 2003. Some notes on the structure of alienable and inalienable possessors. In Coene, M., & D'hulst, Y. (eds) From NP to DP: The expression of possession in noun phrases. Amsterdam: John Benjamins, 167-188.

Aoun J. & Li Y. A. 2003. Essays on the representational and derivational nature of grammar: The diversity of wh-constructions. Cambridge, Mass: MIT.

Bates E. & MacWhinney B. 1982. Functionalist approaches to grammar. In E. Wanner & L. Gleitman (Eds.), Language acquisition: The state of the art (pp. 173-218). New York: Cambridge University Press.

Belletti A. & Contemori C. 2010. Intervention and Attraction. On the production of subject and object relatives by Italian (young) children and adults. In: Costa, J., et al. (Eds.), Language Acquisition Development Proceedings of GALA 2009, Cambridge Scholars Press.

Belletti A. & Chesi C. 2011. Relative Clauses From the Input□Syntactic Considerations from A Corpus-Based Analysis of Italian□Generative Linguistics in the Old World 34, April 28-30.

Bever T. G. 1970. The cognitive basis of linguistic structure. In *Cognition and the Development of Language*, J.R. Hayes (ed.), 279-362. New York NY:Wiley.

Brandt S., Diessel H. & Tomasello M. 2008. The acquisition of German relative clauses. A case study. Journal of Child Language 35, 2, 325-348.

Brandt S. & Kidd E. 2011. Relative clause acquisition and representation: Evidence from spontaneous speech, sentence repetition, and comprehension. In Schönefeld D. (Ed.), Converging evidence. Amsterdam: John Benjamins.

Brandt S., Kidd E., Lieven E. & Tomasello M. 2009. The discourse bases of relativization: An investigation of young German and English-speaking children's comprehension of relative clauses, Cognitive Linguistics 20,3, 539–570.

Brooks, P. J., Braine, M. D. S., Catalano, L., & Brody, R. E. 1993. Acquisition of gender-like noun subclasses in an artificial language: The contribution of phonological markers to learning. Journal of Memory and Language, 32, 76-95.

Cameron-Faulkner, Lieven and Tomasello 2003. A construction based analysis of child directed speech Cognitive Science Vol. 27, Issue 6, pp. 843–873.

Caponigro J. 2002. Free Relatives as DPs with a silent D and a CP complement. In V. Samiian (ed.). Proceedings of the Western Conference on Linguistics 2000: Fresno: Ca: California State University.

Carleton T. & Waksler R. 2000. Pronominal markers in Zenzontepec Chatino. International Journal of American Linguistics , 66, 3., 383-397.

Chan A., Lau E., Lieven E. & Tomasello M. 2007. Cantonese children's acquisition of relative clauses: Cross-linguistic comparisons with English and German children. Paper Presented at the

Conference on the Interdisciplinary Approaches to Relative Clauses (REL07). Cambridge, UK.

Chan A., Matthews S. & Yip V. 2011. The Acquisition of Relative Clauses in Cantonese and Mandarin. In E. Kidd (ed). The Acquisition of Relative Clauses: Functional and Typological Perspectives. John Benjamins.

Chan A., Lau E., Lieven E. & Tomasello M. In prep. Cantonese- and Mandarin- speaking children's processing of relative clauses: Cross-linguistic comparisons with English and German children.

Chang H.-W. 1984. The comprehension of complex Chinese sentences by children: Relative clause. Chinese Journal of Psychology 26: 57-66.

Chang H. W. & Huang H. L. 1986. The development of production and comprehension of DE in Mandarin. NSC report: NSC-74-0301-H002-16, Taiwan.

Chappell Hilary & McGregor William. 1996. Prolegomena to a theory of inalienability. In: Chappell, Hilary & McGregor, William (eds.) The grammar of inalienability, 3-30. Berlin: Mouton de Gruyter.

Chen Jidong & Shirai Y. 2014. The acquisition of relative clauses in spontaneous child speech in Mandarin Chinese. *Journal of Child Language*, 41:1-29.

Cheng Lisa 1986. De in Mandarin. *Canadian Journal of Linguistics*, 31: 313-326.

Cheng S. Y.-Y. 1995. The Acquisition of Relative Clauses in Chinese. MA thesis, National Taiwan Normal University.

Cheng T., Cheung H. & Huang S. 2011. The use of headed and headless DE-marked referential expressions in Chinese mother–child conversation, Language Sciences, 33, 435–458.

Cheung H. 1997. The use of some DE structures in Chinese children's narrative. In: The First Symposium on Discourse and Syntax in Chinese and Formosan Languages, Taipei, pp. 135–153.

Chouinard M. M. & Clark E. V. 2003. Adult reformulations of child errors as negative evidence. Journal of Child Language, (30), 637–669.

Cimiano P. & Wenderoth J. 2007. Automatic Acquisition of Ranked Qualia Structures from the Web. In Proceedings of the 45th Annual Meeting of the Association of Computational Linguistics 2007, pages 888-895.

Coene M. & D'hulst Y. eds. 2003. From NP to DP: The expression of possession in noun phrases. Amsterdam: John Benjamins.

Comrie B. 1996. The unity of noun-modifying clauses in Asian languages. Proceedings of the 4th International Symposium on Pan-Asiatic Linguistics, 1077-88.

Comrie, B. 1997. Attributive clauses in Asian languages: Towards an areal typology. In W. Boeder, C. Schroeder, K. H. Wagner, & W. Wildgen (Eds.), Sprache in Raum und Zeit, In memoriam Johannes Bechert, Band 2: Beiträge zur empirischen Sprachwissenschaft, pp.51–60. Tübingen:Gunter Narr.

Comrie B. 1998. Rethinking the typology of relative clauses. Language Design, 1: 59-85.

Comrie B. 2002. Typology and language acquisition: The case of relative clauses. In Giacalone Ramat (ed.) Typology and Second Language Acquisition. Berlin: Mouton de Gruyter.

Comrie B. 2007. The acquisition of relative clauses in relation to language typology. Studies in Second Language Acquisition 29: 301-309.

Correa, L.M.S. (1995). An alternative assessment of children's comprehension of relative clauses. Journal of Psycholinguistic Research 24: 183-203.

Costa J., Lobo M., Silva C. & Ferreira, E. 2011. Subject–object asymmetries in the acquisition of Portuguese relative clauses: Adults vs. children, Lingua 121, 1083-1100.

Dasinger L. & Toupin C. 1994. The development of relative clause functions in narratives. In Ruth A. Berman and Dan I. Slobin (eds.), Relating Events in Narrative: A Cross-linguistic Developmental Study, 457-514. Hillsdale, NY: Erlbaum.

den Dikken M. & Singhapreecha P. 2004. Complex noun phrases and linkers. *Syntax*, 7 (1): 1-54.

Diessel Holger & Tomasello Michael 2000. The development of relative clauses in spontaneous child speech. Cognitive Linguistics 11: 131-151.

Diessel Holger & Tomasello Michael 2005. A new look at the acquisition of relative clauses. Language 81: 1-25.

Diessel Holger 2004. The acquisition of complex sentences. Cambridge: Cambridge University Press.

Diessel Holger 2007. A construction-based analysis of the acquisition of East Asian relative clauses. Studies in Second Language Acquisition 29: 311-320.

Diessel Holger 2009. On the role of frequency and similarity in the acquisition of subject and non-subject relative clauses. In Talmy Givón and Masayoshi Shibatani (eds.), Syntactic Complexity, 251-276. Amsterdam: John Benjamins.

Diessel Holger 2009. The emergence of syntactic productivity. On the role of frequency and similarity in the development of children's relative clauses, LMU München, Linguistics Colloquium, December 3, 2009. [Invited talk]

Diessel Holger 2013. Construction Grammar and First Language Acquisition. In Graeme Trousdale and Thomas Hoffmann (eds.), *The Oxford Handbook of Construction Grammar*, 347-364. Oxford: Oxford University Press.

Dixon R. M. W. 2000. Categories of the noun phrase in Jarawara. Journal of Linguistics, 36, 487-510.

Dryer M. 2005. The relationship between the order of object and verb and the order of relative clause and noun. In The world Atlas of Language Structures, M. Haspelmath, M. Dryer, D. Gil & B. Comrie (eds), Chapter 96. Oxford:OUP.

Ferreira V. S. & Bock K. 2006. The functions of structural priming. Language and Cognitive Processes, 21, 1011 – 1029.

Fillmore C. J. & Atkins B. T. 1992. Toward a frame-based lexicon: the semantics of RISK and its neighbors. In Frames, Fields, and Contrasts, A. Lehrer and E.F. Kittay (eds), 75-102. Hillsdale, NJ: Lawrence Erlbaum Assoc.

Fillmore C. J. 1977. Topics in lexical semantics. In Current Issues in Linguistic Theory, R. Cole (ed.), 76-138. Bloomington: Indiana University Press.

Fillmore C. J. 1982. Frame semantics. In Linguistics in the Morning Calm, C. J. Fillmore (ed.), 111-138. Linguistic Society of Korea. Seoul: Hanshin Publishing Co.

Flynn S. & Foley C. 2004. On the Developmental Primacy of Free relatives, MIT Working Papers in Linguistics 48, 59-69.

Flynn S. & B. Lust 1981. Acquisition of relative clauses: Developmental changes in their heads. In W. Harbert and J. Herchensohn (eds.), Cornell Working Papers in Linguistics, Volume I, Ithaca, NY: Department of Modern Languages and Linguistics, Cornell University.

Flynn S., Foley C. & L Vinnitskaya. 2000. Evidence for grammatical mapping in second language acquisition. Paper presented at annual meeting of the Linguistic Society of America.

Foley C. 1996. Knowledge of the Syntax of Operators in the Initial State: The Acquisition of Relative Clauses in French and English. Doctoral dissertation, Cornell University.

Friedmann N. & Novogrodsky R. 2004. The acquisition of relative clause comprehension in Hebrew: a study of SLI and normal development. Journal of Child Language 31, 661–681.

Fukui N. & Takano Y. 1998. "Symmetry in Syntax: Merge and Demerge". Journal of East Asian Linguistics 7: 27-86.

Fukui N. & Takano Y. 2000. Nominal structure: an extension of the symmetry principle. In The derivation of vo and ov (Ed.) P. Svenonius, 321-362. Dordrecht: Klumer.

Gennari S. P. & MacDonald M. C. 2008. Semantic indeterminacy in object relative clauses. Journal of Memory and Language, 58(2), 161.

Gibson E. & Wu H.-H. 2011. Processing Chinese Relative Clauses in Context. Language and Cognitive Processes. First published on: 07 March 2011 (iFirst)

Gibson E. 1998. Linguistic complexity: Locality of syntactic dependencies. Cognition 68, 1-76.

Gibson E. 2000. The dependency locality theory: A distance-based theory of linguistic complexity. In Image, Language, Brain, Y. Miyashita, A. Marantz & W. O'Neil (eds), 95-126. Cambridge MA: MIT Press.

Gómez R. L. & Gerken L. A. 2000. Artificial language learning and language acquisition.Trends in Cognitive Sciences, 4, 178–186.

Gómez R. L. 2002. Variability and Detection of Invariant Structure, Psychological Science, 13, 5,431-436.

Green T. R. 1979. The necessity of syntax markers: Two experiments with artificial languages, Journal of Verbal Learning and Verbal Behavior, Vol. 18, pp.481 – 496.

Guo Rui. 2000. De zi de zuoyong (the function of the particle DE in Mandarin Chinese). In Lu Jianming et al. (eds.) *Mianlin Xinshiji Tiaozhan de Xiandai Hanyu Yufa Yanjiu* (Modern Chinese Grammar Studies: Meeting Challenge of the New Century). Jinan: Shandong Education Publishing House.

Hamburger Henry 1980. A deletion ahead of its time. Cognition 8: 389-416.

Hamburger Henry & Stephen Crain 1982. Relative acquistion. In Language development: Syntax and Semantic, ed. Stan A. Kuczaj, 245–274. Hillsdale, NJ: Lawrence Erlbaum.

Hawkins J. A. 1994. A Performance Theory of Order and Constituency. Cambridge: Cambridge University Press.

Hawkins J. A. 2004. Efficiency and Complexity in Grammars. Oxford: Oxford University Press.

Hawkins J. A. 2007. Acquisition of relative clauses in relation to language universals. Studies in Second Language Acquisition 29: 337-344.

Heine B. 2006. Possession: Cognitive Sources, Forces, and Grammaticalization, Cambridge: Cambridge University Press

Heine Bernd. 1997. Possession: cognitive forces, sources, and grammaticalization. Cambridge:CUP.

Hsiao Franny & Edward Gibson 2003. Processing relative clauses in Chinese. Cognition 90, 3–27.

Hsu C., Hermon G. & Zukowski A. 2009. Young children's production of head-final relative clauses: Elicited production data from Chinese children. Journal of East Asian Linguistics, 18, 323–360.

Hsu C. 2014. The Role of Age in Mandarin-Speaking Children's Performance of Relation Clauses. Studies in Linguistics, 40.2, 29-54.

Huang C.–T. J. 1982. Logic relations in Chinese and the theory of grammar. PhD thesis, MIT.

Huang Shuanfan 2007. Is there a relative clause construction in spoken Chinese? –A typological perspective. In The First Conference on Language, Discourse and Cognition. National Taiwan University, Taipei.

Ji Sunjing & Yang Xiaolu 2009. Putonghua mingcixing De De ertong yuyan xide (The emergence of De in Mandarin-speaking children's early nominals). In Cheng, Gong. & Liu, Danqing. (eds) Hanyu de Xingshi yu Gongneng Yanjiu (Formal and Functional Studies in Chinese). Beijing: Commercial Press.

Johnston M. & Busat F. 1996. Qualia Structure and the Compositional Interpretation of Compounds, Workshop On Breadth And Depth Of Semantic Lexicons.

Katrenko S. & Adriaans P. 2008. Qualia Structures and their Impact on the Concrete Noun Categorization Task, The paper present on ESSLLI workshop, University of Amsterdam, the Netherlands.

Kayne R. S. 1994. The antisymmetry of syntax. Massachusetts: MIT.

Keenan E. L. & Comrie B. 1977. Noun phrase accessibility and universal grammar. Linguistic Inquiry, 8, 63-99.

Keenan Edward & Sarah Hawkins 1987. The psychological validity of the accessibility hierarchy. In Universal grammar:15 essays, ed. E. Keenan, 60–85. London: Routledge.

Kidd E., Brandt S., Lieven E. & Tomasello M. 2007. Object relatives made easy: A cross-linguistic comparison of the constraints influencing young children's processing of relative clauses. Language and Cognitive Processes 22: 860-897.

Kim Y. J. 1987. The Acquisition of Relative Clauses in English and Korean: Development in Spontaneous Production. Doctoral dissertation, Harvard University.

Kirjavainen M & Lieven E. 2011. Acquisition of relative clauses in Finnish: The effect of input, In: Kidd, Evan (ed.), The Acquisition of Relative Clauses: Processing, typology and function . viii, pp. 107–140.

Kong Lingda 1992.《"名 $_1$+的+名 $_2$"结构中心名词省略的语义规则》安徽师大学报 (*Journal of Anhui Normal University*) Vol.20, No.1.

Kuhn von K. 2010. The Acquisition of Relative Clauses in Chintang. MA thesis of the institute of liguistics, University Leipzig.

Kuo K. & Vasishth S. 2006. Processing relative clauses: Evidence from Chinese. Unpublished manuscript, University of Potsdam.

Kwon N., Polinsky M. & Kluender R. 2006. Proceedings of the 25th West Coast Conference on Formal Linguistics, ed. Donald Baumer, David Montero, and Michael Scanlon, 1-14. Somerville, MA: Cascadilla Proceedings Project.

Langacker R. W. 1991. Foundations of Cognitive Grammar, vol. 2, Descriptive Application. Stanford: Stanford University Press.

Langacker R. W. 1995. Possession and possessive constructions. In Language and the Cognitive Construal of the World, John R. Taylor and Robert E. MacLaury (eds.), 51 – 79. Berlin/New York: Mouton de Gruyter.

Lau E. 2006. The acquisition of Relative Clauses by Cantonese Children: An Experimental Approach. Mphil thesis, The University of Hong Kong.

Lee K.-Y. 1991. On the First Language Acquisition of Relative Clauses in Korean: The Universal Structure of COMP. Ph.D. dissertation, Cornell University.

Lee Thomas H.-T. 1992. The Inadequacy of Processing Heuristics: Evidence from Relative Clause Acquisition in Mandarin Chinese. In Research on Chinese linguistics in Hong Kong, ed. T. Lee, 47-85. Hong Kong: Linguistic Society of Hong Kong.

Lenci A. et al. 2000. SIMPLE Work Package 2 Linguistic Specifications, Deliverable D2.1, The Specification Group.

Lichtenberk F. 1983. Relational classifiers. Lingua 60, 147–176.

Lichtenberk F., Jyotsna V. & Chen Hsin-Chin 2011. On the interpretation of alienable vs. inalienable possession: A psycholinguistic investigation. Cognitive Linguistics 22: 659-689.

Lieven Elena & Tomasello Michael 2008. Children's first language acquisition from a usage-based perspective: In P.Robinson and N.Ellis (eds). *Handbook of Cognitive Linguistics and Second Language Acquisition*. pp. 168-196.

Lin C-J. C. & Bever T. G. 2006. Subject preference in the processing of relative clauses in Chinese. Proceedings of the 25th West Coast Conference on Formal Linguistics, ed. Donald Baumer, David Montero, and Michael Scanlon, 254-260. Somerville, MA: Cascadilla Proceedings Project.

Lin Chien-Jer Charles 2011. "Processing (in)alienable possessions at the syntax-semantics interface." In Raffaella Folli, & Christiane Ulbrich (eds.) Interfaces in Linguistics. Oxford University Press.

Lin Y. & Garnsey S. 2011. Animacy and the Resolution of Temporary Ambiguity in Relative Clause Comprehension in Mandarin. Studies in Theoretical Psycholinguistics Volume 38, pp 241-275.

Li Yan-Hui Audrey 2001. Universal constructions? Relativization in English and Chinese. Concentric 27, 81-102.

Li Yan-Hui Audrey 2007. Phrase structures and categorical Labeling: De as a head? Contemporary Linguistics 2, 97-108

Lust B. 1994. Functional projection of CP and phrase structure parameterization: An argument for the strong continuity hypothesis. In Syntactic Theory and First Language Acquisition: Cross-Linguistic Perspectives, Volume 1: Heads, Projechons, and Leamability, edited by B. Lust, M. Sufier, and J. Whitman. New Jersey: Lawrence Erlbaum, pp. 85-118.

Lü Sh.-X. 1979. 汉语语法分析问题. The Commercial Press.

Lü Sh.-X. 1980. *Xiandai Hanyu Babai Ci* (Eight hundred words in modern Chinese). Beijing: Commercial Press.

MacDonald M. C. 1999. Distributional information inlanguage comprehension production and acquisition:three puzzles and a moral. In B. MacWhinney, ed., The Emergence of Language, 177-196. Mahwah,NJ: LawrenceErlbaum.

MacWhinney B. 2000. The CHILDES Project: Tools for Analyzing Talk. Third Edition. Mahwah, NJ: Lawrence Erlbaum Associates, 2 vols.

Mak W. M., Vonk W. & Schriefers H. 2006. Animacy in processing relative clauses. Journal of Memory and Language 54: 466-490.

Matsumoto Yoshiko 1988. Semantics and pragmatics of noun-modifying constructions in Japanese. Berkeley Linguistics Society 14: 166-175.

Matsumoto Yoshiko 1997. Noun-Modifying Constructions in Japanese: A Frame-Semantic Approach. Amsterdam: John Benjamins.

Matsumoto Yoshiko 2007. Integrating Frames: Complex Noun Phrase Constructions in Japanese. In Aspects of Linguistics: In Honor of Noriko Akatsuka (Gengogaku no Syosoo: Akatsuka Noriko Kyoozyu Kinen Ronbunsyuu), S. Kuno, S. Makino & S. Strauss (eds), 131-154. Tokyo: Kurosio Publishers.

Matthews S. & Yip V. 2002. Relative clauses in early bilingual development: Transfer and universals. In Typology and Second Language Acquisition, A. Giacalone Ramat (ed.), 39-82. Berlin: Mouton de Gruyter.

Matthew S. Dryer. 2013. Order of Relative Clause and Noun. In: Dryer, Matthew S. & Haspelmath, Martin (eds.) The World Atlas of Language Structures Online. Leipzig: Max Planck Institute for Evolutionary Anthropology. (Available online at http://wals.info/chapter/90, Accessed on 2013-12-16.)

McKee Cecile, McDaniel Dana & Snedeker Jesse 1998. Relatives children say. Journal of Psycholinguistic Research 27: 573–596.

Meyerhoff M. 2002. Communities of Practice, In The Handbook of Language Variation and Change, edited by J.K. Chambers, Peter Trudgill, and Natalie Schilling-Estes. Malden, MA: Blackwell. 526-548.

Miller G. & Fellbaum C. 1991. Semantic networks of English. Cognition, 41:197-229.

Misyak J. B. & Christiansen M. H. 2007. Extending statistical learning farther and further: Longdistance dependencies and individual differences in statistical learning and language. In D.S. McNamara & J.G. Trafton (Eds.), Proceedings of the 29th Annual Meeting of the Cognitive Science Society (pp. 1307-1312). Austin, TX: Cognitive Science Society.

Monaghan P., Chater N. & Christiansen M. H. 2005. The differential role of phonological and distributional cues in grammatical categorisation. Cognition, 96, 143-182.

Morgan J. L., Meier R. P. & Newport E. L. 1987. Structural packaging in the input to language learning: Contributions of prosodic and morphological marking of phrases to the acquisition of language. Cognitive Psychology, 19, 498–550.

Murasugi K. 1991. Noun Phrases in Japanese and English: A Study in Syntax, Learnability and Acquisition. Ph.D. Dissertation, University of Connecticut, Storrs, Connecticut.

Nikolaeva Irina & Spencer Andrew 2010, Nouns as Adjectives and Adjectives as Nouns. http://privatewww.essex.ac.uk/~spena/PossMod/8adjnoun-language-revised-final-non-anon.pdf

Ning C. -Y. & Liu H.-Y. 2009. Milestones in the acquisition of Mandarin Chinese based on HUCOLA. Paper presented in the Workshop on Milestones in the First Language Acquisition of Chinese. Hong Kong: CUHK.

Ning C. Y. 1993. The Overt Syntax of Relativization and Topicalization in Chinese. Doctoral dissertation. University of California. Irvine.

Ning C. Y. 1996. De as a functional head in Chinese. In B. Agbayan, I.K. Takeda, and Sze-Wing Tang, eds., UCI Working Papers in Linguistics 1. ILSA, University of California, Irvine. 63- 79.

O'Grady W. 1997. Syntactic Development. Chicago: University of Chicago Press.

O'Grady William, Miseon Lee & Miho Choo 2003. A subject-object asymmetry in the acquisition of relative clauses in Korean as a second language. Studies in Second Language Acquisition, 25, 433-448.

Onnis L., Christiansen M., Chater N. & Gomez R. 2003. Reduction of Uncertainty in Human Sequential Learning: Evidence from Artificial Grammar Learning. In R. Alterman & D.

Kirsh (Eds.). Proceedings of the 23rd Annual Conference of the Cognitive Science Society (6 pages).

Ozeki H. & Shirai Y. 2005. Semantic bias in the acquisition of relative clauses in Japanese. In A. Brugos, M. R. Clark-Cotton & S. Ha (Eds.), Proceedings of the 29th Annual Boston University Conference on Language Development, Volume 2 (pp. 459-470). Somerville, MA: Cascadilla Press.

Ozeki H. & Shirai Y. 2007a. The consequences of variation in the acquisition of relative clauses: An analysis of longitudinal production data from five Japanese children. In Diversity in Language: Perspectives and Implications, Y. Matsumoto, D. Y. Oshima, O. W. Robinson & P. Sells (eds.), 243-270. Stanford, CA: CSLI Publications.

Ozeki H. & Shirai Y. 2007b The acquisition of Japanese noun-modifying clauses: A comparison with Korean. In Proceedings of the 15th Japanese/Korean Linguistics Conference, N. H. McGloin & J. Mori (eds.), 263-274. Stanford, CA: CSLI Publications

Ozeki H. & Shirai Y. 2007c. Does the noun phrase accessibility hierarchy predict the difficulty order in the acquisition of Japanese relative clauses? Studies in Second Language Acquisition, 29: 169-196.

Ozeki H. & Shirai Y. 2010. Semantic bias in the acquisition of relative clauses in Japanese. Journal of Child Language 37: 197-215.

Packard J. L. 1988. The first-language acquisition of prenominal modification with DE in Mandarin. Journal of Chinese Linguistics, 16, 1, 31–54.

Pu M.-M. 2007. The distribution of relative clauses in Chinese discourse. Discourse Processes, 43(1), 25–53.

Pustejovsky J. 1995.The Generative Lexicon. Cambridge, Massachusetts: The MIT Press.

Pustejovsky J. 2000. Events and the Semantics of Opposition, In Tenny. C & Pustejovsky, J. ed. Events as Grammatical Objects, CSLI Publications, p445-481.

Pustejovsky J. 2001. Type Construction and the Logic of Concepts. In The Syntax of Word Meaning, P.Bouillon and F.Busa (eds.), Cambridge University Press.

Pustejovsky J. 2006. Type Theory and Lexical Decomposition, Journal of Cognitive Science, 6, 39-76.

Pustejovsky J. & Jezek E. 2008. Semantic Coercion in Language: Beyond Distributional Analysis, Distributional Models of the Lexicon in Linguistics and Cognitive Science, special issue of Italian Journal of Linguistics, 20,1, 175-208.

Rizzi, L. 2004. Locality and left periphery. In Structure and Beyond: The Cartography of Syntactic Structures, A. Belletti (ed.), 223-251. New York: Oxford University Press.

Ross C. 1983. On the functions of Mandarin de. Journal of Chinese Linguistics, 11(2), 214-246.

Roth, P. F. 1984. Accelerating language learning in young children. Journal of Child Language 11, 89–107.

Rubin E. 1994. Modification: A syntactic analysis and its consequences. Doctoral dissertation, Cornell University, USA.

Rubin E. 2002. The Structure of Modifiers. Draft ms retrieved at http://www.linguistics.utah.edu/Faculty/Rubin.

Saffran J. R. 2001. The use of predictive dependencies in language learning, Journal of Memory and Language, 44(4), 493-515.

Saffran J.R. 2003. Statistical language learning: Mechanisms and constraints. Current Directions in Psychological Science, 12, 110-114.

Shi D. X. 2008. De he De zi jiegou.(De and De construction). Dangdai Yuyanxue (Contemporary Linguistics), 10(4), 298-307.

Shi D. X. 2011. *Noun and Nominals*. Peking University Press.

Simpson Andrew 2002. On the Status of 'modifying' DE and the Structure of the Chinese DP. In S.-W. Tang and L. L. C. Sheng (eds.) On the Formal Way to Chinese languages. CSLI Publications, Stanford, CA, 74-101.

Slobin, D. 1985. Crosslinguistic evidence for the language-making capacity. In D.I. Slobin (Ed.), The crosslinguistic study of language acquisition, Volume 2: Theoretical issues. Hillsdale, NJ: Lawrence Erlbaum Associates.

Snow C. E. & Ferguson C. A. 1977. Talking to children. Cambridge: Cambridge University Press.

Su Y-Q. 2004. Relatives of Mandarin Children, Paper presented on GALANA, 2004.

Sun Chaofen 2012. From Nouns to Phrases in Modern Chinese: the Uses of Grammatical Marker de. Presentation in The Chinese University of Hong Kong.

Suzuki T. 2011. A case-marking cue for filler–gap dependencies in children's relative clauses in Japanese. Journal of Child Language. 38, 5:1084-1095.

Taylor J. 1996. Possessives in English. Oxford University Press, New York.

Tjung Y. 2006. The Formation of Relative Clauses in Jakarta Indonesian: A Subject-object Asymmetry. Ph.D. Dissertation, University of Delaware.

Tomasello Michael 2003. Constructing a language: A usage-based approach to language acquisition. Cambridge: Harvard University Press.

Tomasello Michael 2006. Why don't apes point? In N J Enfield & S C Levinson (eds), Roots of Human Sociality: Culture, cognition and interaction. Oxford & New York: Berg, pp.506-524.

Traxler Matthew J., Williams Rihana S., Blozis Shelley A. & Morris Robin K. 2005. Working memory, animacy, and verb class in the processing of relative clauses. Journal of Memory and Language 53, 204–224.

Traxler J. & Morris R. & Seely R. 2002. Processing subject and object relative clauses: Evidence from eye movement. Journal of Memory and Language 74: 69-90.

Tsai W-T, Dylan 1992. The Null Topic Parameter and Discourse-linking, The Fourth North American Conference on Chinese Linguistics, University of Michigan, Ann Arbor, USA.

Tsai Hui-Chin Joyce 2008. On Gapless Relative Claauses in Chinese, Nanzan Linguistics: Special Issue 5, 109-124.

Tsou B., Lee T., Cheung H. & Tung P. 2009. Some highlights from the HKCOLAS project: Explorations in language development in a linguistically complex society. Paper presented in the Workshop on Milestones in the First Language Acquisition of Chinese. Hong Kong: CUHK.

Tsou B., Lee T., Tung P., Chan A., Man Y. & To C. 2006. Hong Kong Cantonese Oral Language Assessment Scale. Hong Kong: City University of Hong Kong Press.

Vikner C. & Jensen P. A. 2002. A Semantic Analysis of The English Genitive. Interaction of Lexical and Formal Semantics, Studia Linguistica 56,2, 191-226.

Vossen P., Bloksma L., Climent S., M. Marti Anonia, Oreggioni G., Escudero G., Rigau G., Rodriguez H., Roventini A., Bertagna F., Alonge A., Peters C. & Peters W. 1998. The Restructured Core wordnets in EuroWordnet: Subset1. EuroWordNet(LE-4003) Deliverable D014/D015, University of Amsterdam.

Wang S. & Huang C. R. 2010. Adjectival Modification to Nouns in Mandarin Chinese: Case Studies on "cháng+noun" and "adjective+tú shū gun", In proceeding of: The 24th Pacific Asia Conference on Language, Information and Computation (Paclic-24).

Wang S. & Huang C. R. 2011a. A Generative Lexicon Perspective to Possessive Relation in Mandarin Chinese, Proceedings of 12th Chinese Lexical Semantics Workshop. 201-213.

Wang S. & Huang C. R. 2011b. Compound Event Nouns of the 'Modifier-head' Type in Mandarin Chinese, 25th Pacific Asia Conference on Language, Information and Computation, pages 511–518.

Wang N.-H. 1996. The syntactic development of 'DE' constructions in Mandarin-speaking children. M.A. Thesis, Fu Jen University.

Wen Binli 1996. The syntax of Chinese and English free relatives. PhD thesis, Guangdong University of Foreign Studies.

Wu F., Kaiser E. & Andersen E. 2011. Subject Preference, Head Animacy and Lexical Cues: A Corpus Study of Relative Clauses in Chinese, In H. Yamashita, Y. Hirose & J. Packard (Eds), Processing and producing head-final structures. 173-193. Dordrecht: Springer.

Yamada I., Baldwin T., Sumiyoshi H., Shibata M. & Yagi M. 2007. Automatic Acquisition of Qualia Structure from Corpus Data. IEICE Transactions Inf. & Syst., vol. E90-D.

Yassir Tjung 2006. The Formation of Relative Clauses in Jakarta Indonesian: A Subject-Object Asymmetry, PhD. dissertation of the University of Delaware.

Yip V. & Matthews S. 2007. Relative clauses in Cantonese-English bilingual children: Typological challenges and processing motivations. SSLA 29: 277-300.

Yoon Jae-Hak. 1993. Different Semantics for Different Syntax: Relative Clauses in Korean. Working Papers in Linguistics 42: 199-226. The Ohio State University.

Zavaglia C. & Greghi J. 2003. Homonymy in Natural Language Processes: A Representation Using Pustejovsky's Qualia Structure and Ontological Information. In Computational Processing of the Portuguese Language.

Zhang Baosheng 2007. 《"名 $_1$+的+名 $_2$"中名 $_2$的省略》 河南大学学报（社会科学版） (*Journal of Henan University, Social Science*) Vol.47.3.

Zhang N. N. 1999. Chinese De and the De-construction. *Syntax*, 2: 27-49.

Zhu D. X. (朱德熙) 1961. Shuo *de* (说"的"). *Zhongguo Yuwen* (中国语文，Studies of the Chinese Language), 12: 1-15.

Zhu D. X. (朱德熙) 1966. Guanyu "Shuo *de*" (关于《说"的"》). *Zhongguo Yuwen* (中国语文，Studies of the Chinese Language), 1. Reprinted in *Zhu Dexi Wenji* (朱德熙文集) (1999, Vol. 2) (pp.131-151). Beijing: The Commersial Press.

Zukowski Andrea. 2001. Uncovering grammatical competence in children with Williams syndrome. Ph.D. Dissertation, Boston University.

Zukowski Andrea. 2009. Elicited production of relative clauses in children with Williams syndrome. Language and Cognition Processes 24: 1–42.